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MEDDLING WITH WIRELESS.

That the amateur wireless-telegraph operators have not yet been fully awakened to a sense of their responsibility is shown by the recent sending of false distress signals to the receiving station in Chicago. The use of wireless apparatus in this way is very objectionable and is even more to be frowned upon than the interference with commercial or naval messages which has often occurred. In one recent case, several boats started out to give relief to the craft supposed to be in danger, and were thus inconvenienced.

Such practice on the part of the amateur wireless operator can not be too strongly condemned. Messages of this nature, as well as those which interfere with commercial messages, have caused the agitation against non-professional wireless operators and have already brought them into some disrepute.

The novelty of telegraphing without connecting wires and the fascination of receiving and sending messages have won many devotees, particularly among young men. There is something in it that appeals to youth. There is, however, absolutely no reason why these experimenters should use their apparatus for the purpose of deceiving or interfering with others. The fact that the apprehension of these persons is difficult should be taken as one more reason why they should not stoop to deception. The mere fact that a man has in his possession a wireless set cannot be taken as an indication that he is using it to the detriment of others, nor should it be so considered. One man among a great many experimenters may be causing unjust blame to rest on a number of others. But as in other problems of organized society, restrictive legislation will become necessary to restrain the few from interfering with the rights of others, unless these few desist of their own volition or can be controlled by their fellow-workers.

Already several societies have been formed by those interested in wireless communication, and the rules of these bodies are such that while they allow members to derive the full benefits from their experiments and practice, they do this without making nuisances of themselves. Wireless societies such as have already been formed in Boston, Philadelphia, Chicago and other cities are working toward a good end and should be given every encouragement. When other cities, particularly those situated on the coast and the

great lakes have similar societies, perhaps the wireless problem will be solved without further legislation.

CENTRAL STATIONS AND THE ELECTRIC VEHICLE.

When it is considered that, as a current consumer, an ordinary electric pleasure vehicle gives the same gross income as three ordinary residences, while a 1,000-pound delivery wagon equals thirteen residences in point of revenue, with the advantage that the vehicle load is seldom, if ever, on the peak, the statement that the electric vehicle is the best undeveloped, prospective load for the central station to-day, seems to be well founded.

The introduction of electric vehicles is slow work, but not difficult, and once a start is made, the business grows almost of itself. The start is always hard, and for a good reason—the public, generally, is ignorant of the present status of electric vehicles. It does not realize that to-day these cars are more dependable, just as sturdy, and foolproof to a much greater extent than any other means of city or suburban transportation.

The first step toward promoting the use of electric cars in any locality should be their adoption by the central station itself, just as the first step in an electric sign campaign is the erection of a sign over the central-station office. The people look to the central station to take the initiative.

The next point is the establishment of at least an advisory engineering department or vehicle inspection department which will supervise, to some extent, the management of electric cars within the company's territory. Whether or not the central station should maintain a garage for public use is optional but the inspection and advisory work are absolutely essential.

It is the duty of the company, desiring electric-vehicle business, to co-operate with public garages and electric vehicle and storage-battery manufacturers, who are always willing to give every assistance desired.

If a central station establishes an automobile department, in the hands of men thoroughly acquainted with the work they are doing and then demonstrates to the public what the electric vehicle will do when properly applied and intelligently cared for, the results should more than justify the expense and effort.

ADVERTISING VALUE OF EXPOSITIONS.

Our Scottish contemporary, *The Engineer and Iron Trades Advertiser*, in an article on domestic and foreign exhibitions, gives an example of the advertising value of expositions. Speaking of a certain well known British concern, it says: "This firm has attended the most important exhibitions at home and abroad during recent years, and has secured the highest International Awards, and although meeting with keen competition has been able to go into foreign markets and beat competitors on their own ground, while at home, although the competition is enormous, it holds a very secure position, and has a steadily increasing trade."

The deduction to be made from this statement is that the firm which brings its products visibly to the attention of potential buyers has, other things being equal, a greater chance of increasing its trade than has a concern which does not adopt this method of advertising to the same extent. Advertising, to be effective and efficient, must be continuous and repetitive. The use of advertisements day after day and week after week in the same mediums is bound to bring results, whereas a single advertisement might easily pass by unnoticed. And when this is supplemented by a visible exhibit, and if possible an actual demonstration, results are made all the more certain. In an exposition which lasts for several consecutive weeks an attractive exhibit will be seen many times by the same person who is making an extended stay, and the value of the repetitive and ocular advertisement thus afforded is unquestionable. If we are to increase our export trade we must exhibit in a convincing manner at all the important foreign expositions.

REASONS FOR A SUCCESSFUL POWER CAMPAIGN.

It is interesting and instructive to review the reasons determining success in an energetic campaign for electric power business. The central-station manager today, who sits quietly in his office waiting for business to be offered him, finds his callers few and far between. The great movement of the industry toward commercialism of output may be regretted by certain theorists, but it is a logical outcome of the application of modern methods to the total station revenue and improved conditions of production. Each case of power application must obviously be investigated upon its own merits, but experience gained in a number of recent successful attempts to capture power business shows that there were contributing factors often present in other situations which have not yielded to central-station treatment.

A somewhat extended survey of a number of steam-driven installations which have since all been taken over by the local central-station company disclosed operating conditions which are anything but favorable to efficient running. Engineers whose training extends through the past ten years easily fall into the habit of expecting to find poor practice exceptional, even in mechanically driven plants. It comes as something of a surprise to visit installations where perhaps a thousand feet of shafting are run to drive equipment which might be concentrated in a group not over seventy-five feet long; to find engines twenty or thirty years old in service under conditions which preclude operation within fifty pounds of the initially rated steam-pressure requirements; daily deliveries of coal on

account of there being practically no storage capacity on the premises; complex layouts of belting and shafting which necessitate shutting down an entire factory to remedy a simple localized trouble; and continued operation at speeds fifteen or twenty per cent below that required for the utilization of the normal machine capacity.

In each of the cases in mind careful analyses were made of the total yearly cost of operation by electricity, including fixed charges, compared with the existing steam service. Among the causes which led to the better showing of electricity were the necessity of purchasing feed water from a local company, on account of the inferior quality of artesian well water; the high cost of individual electric lighting due to the subdivision of bills among different establishments under the same roof; the difficulty of meeting increasing demands for electric power generated in restricted quarters; the necessity of shutting down the entire motive power of the factory for a week each year, suspending at the time all production in the establishment except that possible by manual means; the inability of the owners of the old structures to run their apparatus overtime except at prohibitive expense, compared with a nominal extra cost under the new conditions of electric driving; and the presentation of the electrical proposition at a time when the existing belting was so far worn out that the cost of replacement went a long way toward purchasing the motors which superseded the shafting and belts.

Electricity superseded mechanical power in several out-of-door plants where the steam-heating situation was negligible and where the operation was over a period of sufficient length to attract a low rate on the regular published schedule discounts of the central-station establishment. Here the demand for power at specific machines was relatively large, often from fifty to seventy-five horsepower per motor, and the load factor was fairly good in relation to the period of service. Finally, much time was spent in cultivating friendly relations with the steam engineers who were running the old plants, avoiding any sarcastic references to the character of indicator cards which some of the engines displayed. The work was handled on the basis of trying to secure the maximum improvement possible, and in no case were the old engineers thrown out of work. The conditions under which these often old and faithful employees labored were greatly improved by the electrification of the properties which they served, and under the new conditions plenty of work was found for them in connection with the operation of the heating systems, maintenance of motors and machinery, care of elevators, pumps, piping and other accessories. In one or two instances the owners of steam plants which were electrified insisted on retaining their old engines as a so-called guarantee against the failure of the electric service, but in a few weeks the attachment for such antiquated apparatus gave way to a decided willingness to offer it up on the second-hand-machinery altar. The reliability of modern central-station service is easily demonstrated today to the most skeptical contractor for power.

FORM FACTOR.

In spite of the fact that two of the most prominent electrical societies of the country have this year been formulating definitions of electrical terms, the important quantity known as form factor has thus far failed to receive the attention which it deserves.

Neither the Standardization Rules of the American Institute of Electrical Engineers nor the Report of the Committee on Terminology of the National Electric Light Association makes any reference to this important quantity. The form factor is important because it connects the maximum value of the magnetic flux which periodically links any coil with the electromotive force induced in the coil, and it is the maximum value of the flux which determines the iron loss. Attempts have been made in some quarters to supplant the form factor by other quantities, such as amplitude factor, but the form factor still remains the most convenient quantity to use in expressing the necessary relations of the quantities concerned.

The form factor is defined as the ratio of the effective value to the average value of a periodic quantity, and as this definition is generally accepted, it may be considered unnecessary to consider the matter further.

The effective value is universally understood to mean the square root of the average value of the square of the varying quantity. But there is a lack of uniformity in the definition of the average value of a periodic quantity, simple as the matter appears at first sight. One author defines it as the average of all the instantaneous values in the cycle, without regard to sign. Another defines it as the algebraic average for a half period. Some do not define it at all.

The difficulty arises in cases where the wave passes through the zero value more than twice per cycle, that is, in certain cases of a very much distorted wave of electromotive force. Definitions, of course, should be framed so as to cover all cases which may occur in practice. And when well known authors differ in definitions, the term is a proper subject for standardization.

In order to have the relation between flux and electromotive force hold in all cases, with the above definition of form factor, it is necessary to define the average value of a periodic quantity as the *algebraic* average over a half period beginning with the value zero. If the variable pass through zero more than twice per cycle, that zero should be used as the initial point which will give the greatest algebraic value. If the *numerical* average be taken for a half period, the form factor defined by it loses all significance in the special case considered.

Association of Railway Electrical Engineers.

The annual convention of the Association of Railway Electrical Engineers will be held at the La Salle Hotel, Chicago, September 27 to 30, and it is expected that nearly every steam road in this country will be represented by its electrical engineer.

The top floor of the hotel, known as the roof garden, has been engaged for the occasion, and will be used exclusively for the meetings and exhibits. The convention has been arranged by the Association of Railway Electric Supply Manufacturers, and the committee in charge is composed of the following gentlemen: Exhibits: W. E. Ballantine, Willard Storage Battery Company. Entertainment, W. H. Glatt, New York Leather Belting Company. Finance, A. C. Moore, Safety Car Light and Heat Company. Auditing, J. M. Lorenz, Central Electric Company. Membership, J. M. Schilling, Westinghouse Electric and Manufacturing Company. Chairman, George H. Porter, Western Electric Company.

The officers of the Association of Railway Electrical Engineers are: president, E. M. Cutting, electrical engineer, Southern Pacific Railway, Oakland, Cal.; first vice-president, J. R. Sloan, electrical engineer, Pennsylvania Railroad, Altoona, Pa.; second vice-president, F. R. Frost, electrical engineer, Atchison, Topeka & Santa Fé Railway, Topeka, Kan.; secretary, George B. Colegrove, chief electrician, Illinois Central Railroad, Chicago, Ill.

Radiology and Medical Electricity.

At the seventy-eighth annual meeting of the British Medical Association, held in London, during the last week of July, the technical proceedings were divided among twenty-one special sections. Of electrical interest were the sessions of the Section on Radiology and Medical Electricity, which assembled on July 27 at the call of its president, Dr. J. Mackenzie Davidson. In his opening address he spoke of the desirability of having all X-ray work done by properly trained medical men, suitably equipped for the work. Many unfortunate results have come from the common belief that radium is a cure for malignant diseases. The fact is that its usefulness is quite limited, but where it is serviceable its action is definite and decisive.

Sir J. J. Thomson delivered a classical address on the physical properties of Roentgen rays and their physiological effects on living tissues. He referred particularly to what are known as the medium and soft rays. He also described a new method of producing Roentgen rays of various degrees by allowing the radiation from an X-ray tube to fall upon a metal surface, the type of ray depending on the kind of metal forming the bombarded surface. For instance if the surface is of iron the radiations corresponded to those of a very "soft" tube, while if the surface is of silver the rays are "harder" and more penetrating; the "hardness" of the secondary radiation increases with the atomic weight of the metal employed. The speaker thought that this principle might be used to produce radiations of any desired intensity for therapeutic purposes.

Dr. H. L. Jones read a paper on the "Treatment of Some Forms of Corneal Ulcer by Zinc Ionization." Several cases of Moore's ulcer have been successfully treated in this way, but it is necessary to get actual penetration of the ions into the corneal substance in order to get satisfactory results. Prof. Leduc said the pain of the operation can be eliminated by increasing the current strength very slowly.

C. T. Holland described a model of a screen for conducting X-ray examinations with the patient in an upright position. The outfit gives at the same time proper protection to the operator.

Dr. R. Morton described and illustrated the changes observed in a case of chronic X-ray dermatitis. Destruction and repair took place alternately and sometimes side by side. Finally destruction predominated and necessitated removal of the diseased phalanx.

Dr. W. F. Somerville read a paper on the "Relief of Pain and Discomfort by Means of High-Frequency Currents." He made a strong plea for the more common use of this method in the various forms of neuralgia, the pain following fractures, muscular rheumatism, and the pain of arthritic joints. He made an emphatic statement that the high-frequency treatment is by no means a thing of the past, in fact the results are remarkably satisfactory when the treatment is carried out by medical men who had a full knowledge of the proper procedure.

Doctors Dominici and Warden presented a paper on the "Radium Treatment of Malignant Disease." The paper was illustrated by several diagrams and also by four patients whom the authors brought from Paris to show the satisfactory character of the results.

Reviewers Raise Taxes of Chicago Electric Concerns.

The assessments of Chicago's two big electric concerns, the Commonwealth Edison and the Chicago Telephone companies, have been raised by the board of review, so that the concerns will pay taxes on about $2,650,000 more personal property than they were called upon to pay on last year. Their combined personalty assessments of $34,482,695 last year have been raised this year to $37,139,281.

The figures for the Commonwealth Edison Company are contained in the following table:

Chicago.	Reviewers. 1909.	Reviewers. 1910.
South town	$10,500,000	$11,200,000
West town	5,000,000	5,500,000
North town	2,250,000	2,450,000
Lake View	1,450,000	1,650,000
Lake	1,225,000	1,520,000
Hyde Park	1,550,000	1,620,000
Totals	$21,975,000	$23,940,000

The Chicago Telephone Company's personalty assessments can be divided into Chicago's figures and those for the thirty country townships outside of the city, as follows:

Chicago.	Reviewers. 1909.	Reviewers. 1910.
South town	$ 5,018,300	$ 5,493,416
West town	2,774,600	3,037,362
North town	2,213,300	2,450,000
Lake	443,000	484,959
Lake View	501,000	548,436
Hyde Park	1,009,000	1,104,592
Jefferson	73,500	80,516
Totals Chicago	$12,132,700	$13,199,281
Totals country towns	374,995	514,395
Totals Cook county	$12,507,695	$13,713,676

These figures indicate increasing prosperity of the electric trade in Chicago.

Sale of Forty-second Street Railway Adjourned.

Judge Lacombe in the United States Circuit Court has signed an order adjourning the sale and the foreclosure proceedings by Edward M. Childs, special master of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, of New York City, under the mortgage by the Union Trust Company, which was set for September 1, until October 18. The sale is for the foreclosure of mortgage dated July 1, 1885, to secure the sum of $1,600,000.

A scheme has been promulgated to inaugurate a workman-exchange between England and Germany. Sir Ernest Cassel has provided a fund of $100,000 for this purpose.

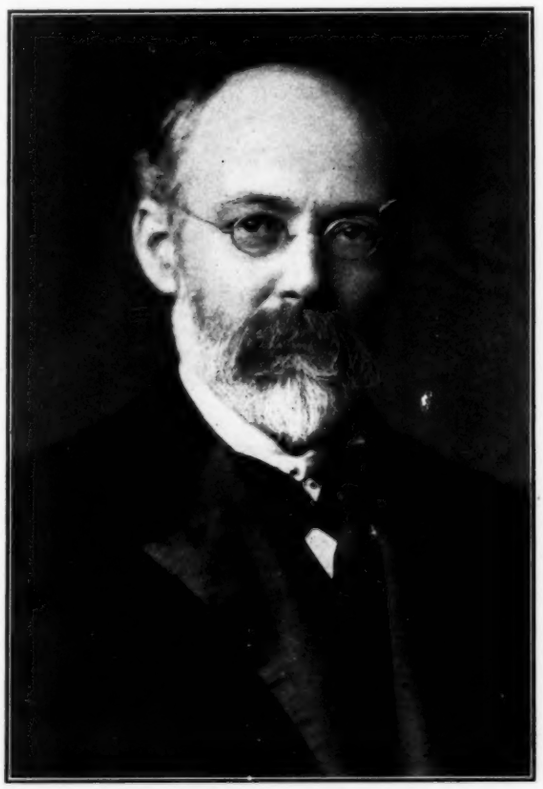
Edwin R. Weeks.

The subject of this sketch has had a long and distinguished career in the electrical industry. In the early days he was recognized as a leader among those hardy pioneers who brought to a skeptical world the first commercial developments of electric lighting.

Edwin Ruthven Weeks, consulting electrical and mechanical engineer, "the father of electric light and power in Kansas City," was born in Westfield, Wisconsin, December 25, 1855. He was a son of Joseph Van Rensselear Weeks and Imogene Cookson Weeks. He was educated in the Kansas City schools, the Phillips Exeter Academy, Tabor College and Spaulding Commercial College. He learned the trade of a mason, was one of the first postmen in Kansas City, and for several years was in the train service of the Union Pacific Railroad. He was superintendent, manager, general manager, vice president and managing director of the Kansas City Electric Light Company and of its predecessor, as well as of the Edison Electric Light and Power Company (1882-1900), which companies under his management were among the most successful in the industry. He sold the electric light and power properties at Kansas City to Armour & Company, and formed the firm of Weeks, Kendall & Newkirk, consulting and mechanical engineers, practicing in many states and territories and abroad.

Mr. Weeks was one of the leading spirits in the early days of the National Electric Light Association. In 1886 he presided at all of the Detroit convention sessions, and was president of the association in 1889 and in 1890, and served on many important committees. He served as vice president of the Association from 1885 to 1888. He is a member of the American Institute of Electrical Engineers and the Franklin Institute, and held membership in the International Electrical Congresses of 1893 and 1904. He was chosen with Dr. Carl Hering to represent the American Institute of Electrical Engineers and the National Electric Light Association on the Jury of Awards at the St. Louis Exposition. He is a member of the American Association for the Advancement of Science, one of the incorporators and vice president of the Kansas City Art Association and School of Design, member of the American Academy of Political and Social Science, a member of the Civil Service Reform Association, a member of the Sons of the Revolution, president of the Humane Society of Kansas City, and vice president of the American Humane Educational Society, of Boston, Mass.

He has delivered many addresses on scientific, educational, economic and humanitarian subjects, and has been a prolific contributor to the educational and technical press.



EDWIN R. WEEKS,
Consulting Electrical and Mechanical Engineer.

He was married in 1883 to Miss Mary Harmon, who was for many years teacher of mathematics and English in the Kansas City high school. He has one daughter, a graduate and Borden fellow of Vassar College.

While Mr. Weeks is known to the electrical fraternity best as a scientific man and as a thoroughly conscientious and enterprising builder of business, he is equally well known in other walks of life as a humanitarian of sincere and brilliant record. He is a life member of the Royal Society for the Prevention of Cruelty, and he was awarded a medal "for humanity" in 1906 by the American Humane Educational Society. The degree of "Doctor of Mercy" was conferred upon him by the greatest convention ever held in the cause of humane education. Mr. Weeks designed and erected the first sanitary fountain for horses in the park at Fortieth and Main Streets, Kansas City, Mo., and it was at this convocation that the above degree was conferred. His latest address of this character was before over 2,000 persons in the largest church in the city of Independence, Mo., where he occupied the pulpit at the morning service of June 5, 1910.

McAdoo Tunnels Progress.

According to a recent statement made by William G. McAdoo, president of the Hudson & Manhattan Railroad Company, work is going forward very rapidly on the Hudson River tunnels.

It is expected that the Thirty-third Street terminal station will be completed and opened about November 1, and the Twenty-eighth Street station will probably be completed at the same time. The extension to Forty-second Street and connection with the train levels of the new Grand Central Station should be completed well within the three-year limit.

These improvements will materially aid in solving the transportation problem in New York.

National Association of Cotton Manufacturers.

The semi-annual meeting of the National Association of Cotton Manufacturers will be held at the Hotel Wentworth, Portsmouth, N. H., September 15, 16 and 17. The full programme will not be issued until the meeting, but a number of interesting papers have been announced. One of these is upon "Illuminating Engineering."

A special train will be run from Boston to Portsmouth on September 15. Full particulars can be obtained from the secretary, C. J. H. Woodbury, 45 Milk Street, Boston, Mass.

The Kinlochleven Hydroelectric Power Plant.

A Modern Works for the Manufacture of Aluminum.

The extensive works of the British Aluminium Company which were proceeded with several years ago at Kinlochleven in Scotland to supplement the company's original installation at the Falls of Foyers, and its other works, for the production of aluminum, possess several features of interest. The great rapidity with which the demand for aluminum has increased compelled the adoption of enterprising methods and the carrying out of an undertaking of large proportions as speedily as possible in preparation for producing many times the former output. Indeed it was found that the large works could not be completed in time to meet the growing need, so a temporary factory was built and equipped in the same neighborhood.

A general idea of the engineering operations involved in the carrying out of this big hydroelectric scheme can be gathered from the accompanying plan which shows the situations of the upper and lower penstock chambers, the temporary railway and overland route, the cableway, and the temporary route, the cableway, and the temporary aluminum factory already alluded to. It shows also the location of the six lines of thirty-nine inches diameter steel pipes on the left, leading to the power house, and the aluminum and carbon factories which are now in full swing; also the Kinlochleven village which has been built up to accommodate the company's workmen and their families. There will further be observed the permanent electric railway leading from the wharf and jetty to the factories.

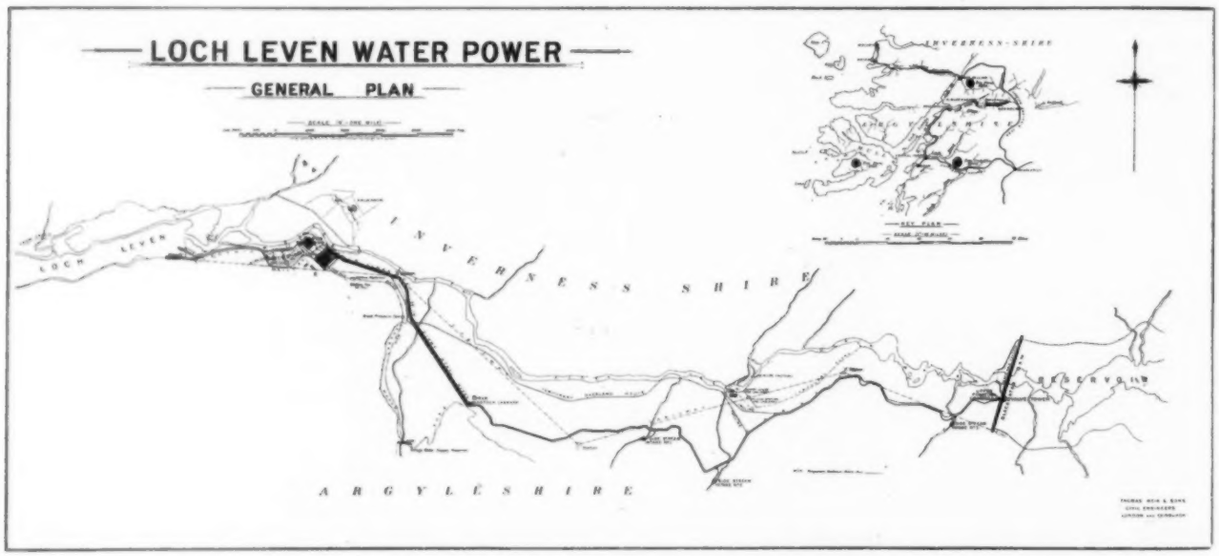
The great concrete dam which created the enormous reservoir, the pipe lines, and a reinforced concrete conduit, were carried out to the plans of Meik and Sons, consulting engineers. The pipe lines are 6,200 feet long from the intake to the power house. Of the six pipe lines now laid one is a spare; room has been left for the addition of two further pipes when the extensions at the station from 30,000 to 40,000 brake-horsepower capacity become necessary.

The power-house building is 420 feet long by 50 feet wide. Measuring direct by the road, it is situated about half a mile from Lochleven. At one end the station is built up with corrugated iron to facilitate extensions to plant. A fifteen-ton electric traveling crane, fifty foot span, travels the entire length of the station, and a railway for unloading machinery, for repair work, and other purposes, runs through it.

The present installation includes nine electric generating sets, each set consisting of an Escher Wyss turbine coupled to a pair of Dick Kerr generators. Each generator has an output of 4,000 amperes at 250 to 275 volts. There is room for two further sets of 2,900 brake horsepower each without increasing the size of the building.

There are also two smaller turbine sets. Each of these turbines drives a 500-kilowatt generator which furnishes a supply for lighting the village (250 volts), for power requirements in the shops, for driving the cranes, and a very small proportion for exciting purposes, and also drives a seventy-five-kilowatt generator normally run at 550 volts, which supplies energy for the locomotives on the railway (to which reference is made later), and for the cranes on the jetty and the wharf.

The turbines, all of which were made by Escher Wyss, have, in the case of the larger ones, two nozzles, and they are fitted with by-pass relief valves for regulating water pressure. The small turbines are fitted with one nozzle and no by-pass, the regulation of these being satisfactorily obtained by means of a flywheel. It is understood that Kennedy & Jenkin, the consulting engineers for the entire turbine and electrical work, have found by actual test that when throwing on or off the full overload, the water hammer in the pipe does not exceed twelve per cent of the static



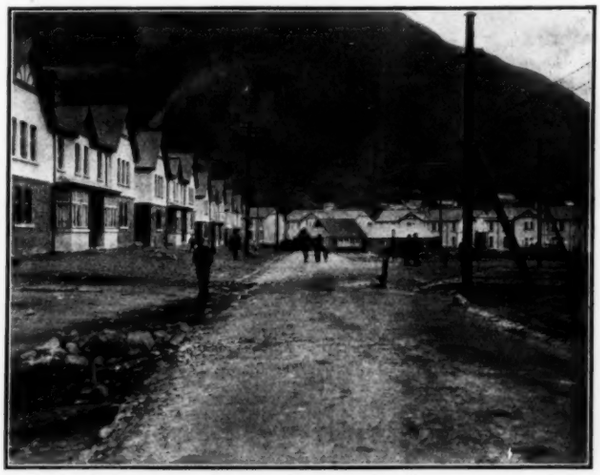
MAP SHOWING GENERAL LAYOUT OF KINLOCHLEVEN WATERPOWER PROJECT.

head, and the momentary variation in speed does not exceed sixteen per cent and the permanent variation three per cent. The large turbines run at a speed of 300 to 330 revolutions and the small turbines at 400 revolutions per minute.

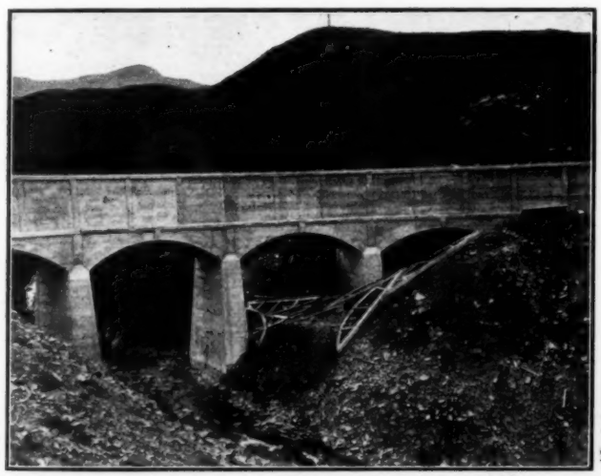
All the Dick Kerr generators are of the direct-current multipolar type, with slot-wound armature, and shunt-wound field. They have to run continuously at full load day and night for months at a time, so all adjustments, brush renewing, and lubrication have to be done while they are running. They are shut down for about ten minutes once a week for cleaning. The normal full-load output of each of the two generators coupled to one of the large turbines is 1,000 kilowatts at 300 revolutions per minute. The overload output is 1,100 kilowatts for one hour, and the machine is capable of adjustment, by alteration of speed only, to give any voltage when self-excited) between 200 volts and 275 volts with any load from 0 to 4,000 amperes. The rise in temperature of the armatures, commutators, field winding, or any other part of the generators or their field switches, does not exceed seventy degrees Fahrenheit above that of the surrounding air after a continuous run of six hours. The magnet frames are constructed of cast iron of high permeability divided horizontally so that the upper half can be removed. The pole-pieces are made of laminated steel and are provided with detachable pole shoes which hold the field spools in place. They are cast into the magnet frames with a cast-welded joint, thus insuring good magnetic conductivity. The armature spider is of cast iron, specially designed to avoid all shrinkage strains. The armature punchings are made from best electrical steel, thoroughly annealed and securely fixed to the ends of the arms of the armature spider. The periphery of the armature laminations is provided with open slots to receive the armature conductors. The armature weighs twelve tons. The commutator is made with hard-drawn copper bars insulated with carefully selected mica. It is carried upon an extension of the armature spider to which it is keyed, and the bars are held in place by steel clamping rings. A wearing depth of two and five tenths inches on the diameter is allowed for. The generator shafts are of specially large diameter in the bearings, and of ample strength to transmit the torque to the second machine. The shafts are of mild steel fitted with a forged-steel half-coupling at each end so that the armatures may be interchangeable.

The supply is fed direct to the furnaces at 250 to 275 volts. A brick wall divides the power house from the

NORTH END OF BLACKWATER DAM.



STREET SCENE IN KINLOCHLEVEN.



BRIDGE SECTION OF REINFORCED CONCRETE.

WHARVES AND ELECTRIC-RAILWAY TERMINUS.

furnaces. Busbars extend along the length of the station so that any single generating set can be put on to any series of furnaces, the remainder being of course on their own series.

It will be observed from the illustration of the power house that there

ELECTRIC LOCOMOTIVE, KINLOCHLEVEN.

is no switchboard for the main units. There is a small slate panel between each pair of dynamos and the furnace room. There is one main ammeter for each generator, one main voltmeter and one ammeter in each field circuit. These panels were made by Kelvin & James White, Limited, and were erected by the British Aluminium Company.

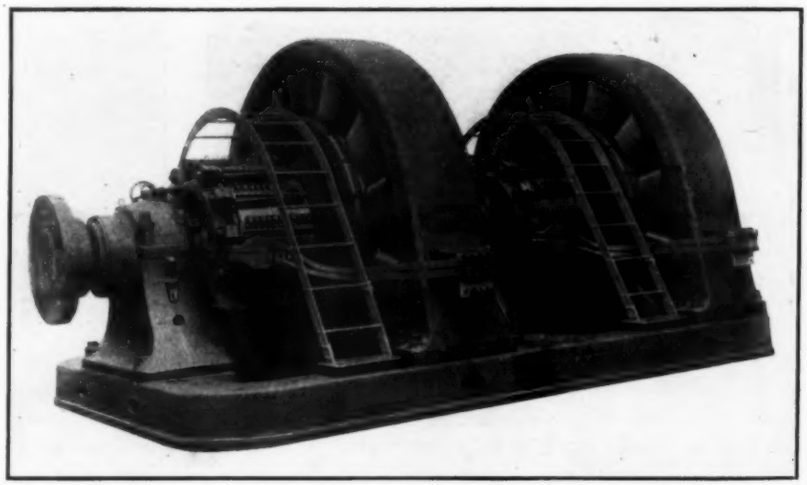
For the lighting and traction machines a switchboard is provided with ordinary feeder and auxiliary panels. All the main connection at the back of the board are made of aluminum strip, the British Thomson-Houston Company being responsible for this part of the work. Aluminum strip bends round very easily and is found to make a very neat job; it is quite stiff enough for all purposes such as dynamo leads. The increased size is no disadvantage, for it results in greater stiffness. All through the station the aluminum strip is of sixty per cent conductivity. From the lighting switchboard there are three pairs of feeders which run out through the power-house wall to the village. Bare aluminum stranded cables are carried on ordinary porcelain insulators on wooden poles. Two of the lighting feeders are thirty-seven strands, each 0.085 of an inch diameter, and the other is of nineteen strands of the same diameter. All the through joints on the feeder cables are cast joints. Outside, the feeders are spaced two feet apart, positive and negative, and the span never exceeds forty yards. The sag between the poles is approximately eighteen inches on the forty-yard span. The writer understands from the consulting electrical engineers, Kennedy & Jenkin, that on careful examination after two years there was found to be no oxidization whatever. The feeders supply the distributing mains in the village through double-pole fuses in cast-iron boxes erected on the poles. The house-service leads are taken off the distributors by mechanical aluminum clips. As they are only T-joints there is no drop on the distributors themselves due to these joints. The clips have aluminum brnze bolts in them and they were painted after erection.

The house-service leads consist of single 0.144-inch diameter bare aluminum wire. This is led from the clips and is anchored on to swan-neck insulators on the side of the house walls. There is a joint made on to each insulated aluminum cable which goes into a fuse box serving four, five or six workmen's cottages. No switches are installed; there is only one fuse on each pole to each cottage, an arrangement which has given quite satisfactory results.

In addition to the feeders there are two pairs of 169-strand cables (0.085 inch diameter), which run between the power house off the switchboard to the carbon factory for the supply of power. Two positive thirty-seven-strand feeders supply the up and down lines on the railway between the power house and the wharf. There is a painted mechanical connection between the copper trolley wire and an

UPPER END OF PIPE TRACK.

aluminum eye cast on to the end of the feeder. This has proved perfectly satisfactory, though the difficulty of jointing copper and aluminum exposed to the weather is sometimes spoken of as being practically impossible.

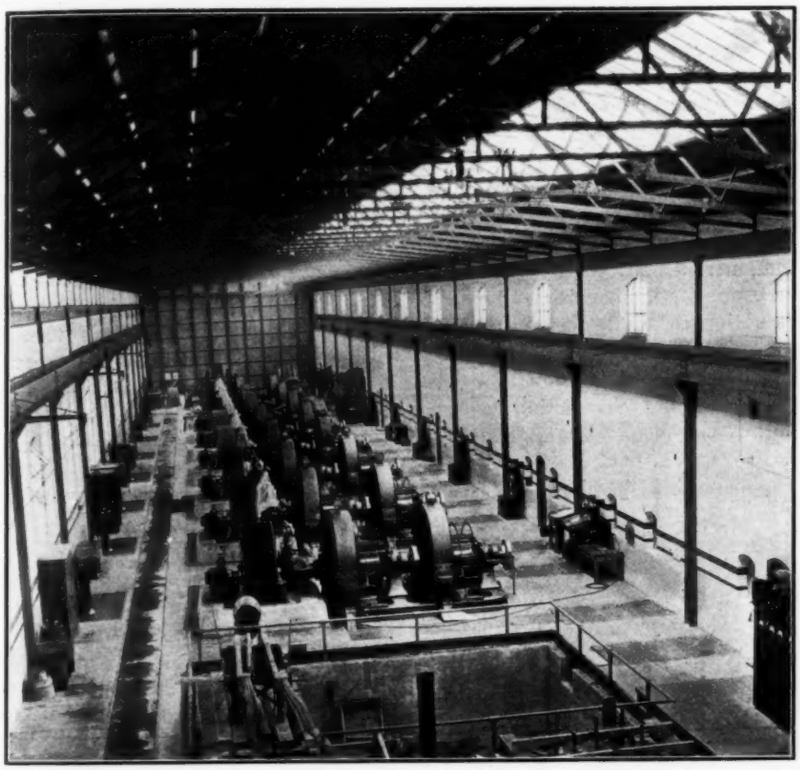


TWO 1,000-KILOWATT GENERATORS FOR COUPLING TO TURBINE.

The electric railway is a three-foot-gauge line with 00 S. W. G. trolley wire run from sixteen to nineteen feet above the level of the road, supported on brackets attached to wooden poles. These poles also carry a separate circuit for lighting the rail-

way. In connection with the village lighting, it should be stated that there is on all the poles a separate circuit for the public lighting by incandescent lamps.

The railway track is made up of sixty-five pound rails laid on ordinary sleepers and ballast. The permanent-way work for this line was carried out to Kennedy & Jenkin's specification by Sir John Jackson's Company which contracted for the dam. The permanent-way work in the factories was done by Dick-Kerr & Company.



INTERIOR OF KINLOCHLEVEN POWERHOUSE.

All the overhead work was carried out by Johnson & Phillips, Ltd.

The two electric locomotives (by Dick-Kerr) are capable of hauling thirty tons behind them up a gradient of 1 in 100 at ten miles an hour. Bow collectors are used, these being necessitated by reason of the large number of sidings round the factories. On the wharf there is a fifteen-ton electric derrick crane, and a three-ton six-foot-gauge locomotive electric jib crane. There is also a two-ton locomotive electric jib crane for use anywhere on the railway. These were made by Carrick & Ritchie and by Stothert & Pitt, respectively.

It has already been stated in this journal that the British Aluminium Company has works also in Continental countries, as well as at Falls of Fozers, and Kinlochleven, these including hydroelectric works at Orsieres in Switzerland, and aluminum works at Stangfjord, in Norway. It also possesses aluminum works at Larne Harbour, and carbon works at Greenock.

The entire electrical equipment of the Kinlochleven undertaking has been carried out to the designs of Kennedy & Jenkin, to whom, and also to Murray Morrison, the general manager of the British Aluminium Company, the writer is indebted for courteous assistance in preparing the foregoing description.

Tungsten Lighting for Sandusky.

Tungsten lamps on ornamental columns are being seriously considered for improving the lighting of the business district of Sandusky, Ohio. Although the present arc-lighting contract does not expire until December 31, 1911, it is already proposed to install ornamental tungsten street lighting about Washington Park and the four blocks adjoining Columbus Avenue between this park and Water Street. Seventy-eight posts are to be erected.

INDIANA ELECTRIC LIGHT ASSOCIATION.

ANNUAL CONVENTION AT INDIANAPOLIS.

The second annual meeting of the Indiana Electric Light Association was held in the Denison House Auditorium, August 17 and 18, 1910.

In calling the meeting to order President C. C. Perry said the large attendance was gratifying, considering the extremely warm weather.

After the reading of the secretary's report, in which he stated that the Association was in good financial condition and that there had been a gain of twenty-seven new members during the year, President Perry delivered his annual address. President Perry said the Association had made some progress during the year, but there was room for still greater improvement. He said the officers had endeavored to do everything possible to build up the Association, but it was found that an organization befitting Indiana cannot be built up in a year or in two years. It requires time to impress the electric utility companies of the importance of membership in the Association. There was too much of a willingness on the part of many companies to allow the more progressive electric utility companies to carry their burden and derive benefits from the Association without being members. He said the Indiana Association could be made one of the strongest in the country and appealed to the members to put forth an effort to make it such during the next year.

Mr. Perry pointed out that this was a legislative year and that the keynote or dominant topic for the opening session of the convention would be as to whether Indiana is ready for a public utility law. Mr. Perry said he did not believe Indiana was ready for a public utility commission.

Charles A. Bookwalter, of the Merchants Heat and Light Company, was on the programme for an address. Mr. Bookwalter said he was a mere beginner in the electric light business and would say nothing along that line. He expressed the belief that the incoming legislature would certainly enact a public utility law. He said the time was ripe for a commission and that the public service corporations in Indiana would have no cause to object

to a commission composed of good men and conducted along proper lines. The prevailing idea of municipalities of granting short-term franchises was unfair and discouraged investments in public-utility plants. He thought a commission would right a good many wrongs now suffered by the people at the hands of the public service companies. He insists that the best asset that a public service corporation has is the good will of the people.

The subject was further discussed in a paper read by T. C. McReynolds, of the Kokomo and Marion Traction and Light Company. Mr. McReynolds declared that results in other states were such as to indicate that state supervision of public utilities had come to stay. The phenomenal growth of public service enterprises for the last twenty years has no parallel in the history of this or foreign countries. Wonderful opportunities have been taken advantage of to amass large individual fortunes by those engaged in public service enterprises. Valuable franchise rights have been procured in many cities in a way to create suspicion and after such rights have been acquired they were abused by many corporations and individuals. Rates have been raised without due notice or just cause and the policy of "take what we see fit to give you" has been conducive to the demand of state supervision.

Mr. McReynolds said he was a believer in regulation and thought there could be no legitimate objection to the enactment of a law having for its purpose regulation in connection with issuing stocks and bonds. If there really is a demand for creating a public service commission let it be understood that such laws are not alone necessary for the protection of public service corporations against the enactment of adverse legislation by city councils. The further discussion of this subject, which lasted practically the entire day, was participated in by C. M. Poor, F. A. Bryan, C. C. Perry, J. V. Zartman, E. J. Condon, C. Francis Harding and others, and without exception all advocated the passage of a public commission bill if properly safeguarded.

The next topic discussed was the relation of central lighting stations to supply houses. In the absence of a paper that was to have been prepared on the subject by Gordon E. Varney the members discussed the matter fully and with considerable feeling. The supply men charged that the plan adopted by the station men in supplying to consumers electric devices at cost and in some instances installing them free in order to get the revenue by reason of an increased consumption of current, was not fair. They insisted if the station men found it necessary to compete with the supply houses and contractors in the sale and installation of electric lamps, irons and other devices, they should sell at list prices.

The station men defended their plan by saying that the supply men were too slow and not active enough in pushing the sale of electric devices. They claimed they often employed incompetent workmen and their installation was defective, giving the station men much trouble. They admitted they sold devices at cost, their object being to receive additional revenue from current, but insisted that they were forced to advertise and demonstrate the use of devices at considerable cost. Both supply men and station men deplored the conditions and agreed to take some action to bring about a better understanding and, if possible, agree upon a scale of prices to be maintained in the sale of electric devices.

Following this discussion, an interesting paper was read on "New Developments in Heating Devices," by W. F. Hadaway, of the Westinghouse Electric and Manufacturing Company, and this in turn was followed by a paper by J. K. McDonough, of the General Electric Company on "Modern Methods of Introducing Current-Consuming Devices." Cooking devices, electric fans, electric sewing machines and other articles recently put on the market were considered.

Both papers were well received and a vote of thanks tendered to the readers for the valuable information contained in their papers.

At the adjournment of the first day's meeting, the members were taken in automobiles to all the electric, water and heating plants in the city, and also the Traction and Terminal Station.

The morning session of the second day's meeting was opened by the reading of a paper by E. Darrow, general superintendent of the Merchant's Heat and Light Company on "Ornamental Street Lighting." This proved a popular topic and Mr. Darrow handled the matter in such an interesting way as to enlighten the members on a question now being brought up to them. He described the different kinds of lamps used, pointing out their merits and demerits as illuminators.

F. W. Shackelford read a paper on "The Economical Operation of Alternating-Current Feeder Systems." In the discussion of this paper many questions were asked of the author which showed the interest manifested in the economic use of current.

An interesting paper was read by Prof. C. Francis Harding on the "Relation of Purdue University to Electric Service Companies of Indiana." At the conclusion of the reading of this paper President Perry said there was not an electric service company nor an electric association in Indiana but what was under deep obligations to Purdue University. The University has not only sent out its talented men to read papers and instruct electric service men but it had sent out hundreds of students to ocupy important positions and all were making good.

The closing session was opened by the reading of a paped by R. A. MacGregor of Connersville on "Municipal Ownership in Indiana." Mr. MacGregor said that municipal ownership and operation of electric light plants in Indiana were proving troublesome to the cities and were a failure. The increasing cost of operation and the rapid depreciation of plant property are proving too great to stem the tide at present rates charged by municipal plants. He said there never would have been the agitation for municipal lighting or plants but for the cold, secretive, take-it-or-leave-it policy that too often dominate public service companies. It has been found that municipal ownership is largely due to the failure of public service companies to get in touch with the public and cultivate their good will. He said that if municipal plants could give the incentive for personal ambition that a privately owned plant could, things might be different. He referred to the bane of political changes in the operation of a city plant and expressed the belief that within a few years cities will be glad to get rid of their plants as some have already done.

Papers were read on the "Commercial Value of Low-Head Water Power," by F. A. Bryan, general manager of the Indiana and Michigan Electric Company, and "Steam Heating Construction" by G. M. Williams, of Indianapolis. These papers were well received. It was evident from the questions asked of Mr. Williams that many of the managers of service plants contemplate utilizing their exhaust steam for heating purposes.

Officers were elected as follows: President, F. A. Bryan, South Bend; vice-president, S. B. Harting, Elwood; secretary-treasurer, J. V. Zartman, Indianapolis. The following committees were appointed: executive committee—R. A. MacGregor, Connersville, chairman; E. Darrow, Indianapolis; J. P. Ohmer, Elkhart, and T. F. Grover, Terre Haute. Advisory committee—C. C. Perry, Indianapolis, chairman; T. C. McReynolds, Kokomo; J. W. Robb, Clinton. Finance committee—C. A. Elliott, Muncie, chairman; J. A. Mincreiff, Bloomington; Felix Cadou, Vincennes; C. M. Poor, Sullivan, and T. A. Wynne, Indianapolis.

A resolution was adopted on the death of Fred Leslie, of Muncie, who was secretary at the time of his death.

A vote of thanks was given the outgoing officers for their zeal and labor toward the upbuilding of the Association during the past year.

The convention adjourned to meet at the time and place selected by the executive committee.

Another Quarry Electrifies.

A dispatch from Norwich, Conn., states that the Smith Granite Company is installing a modern electric plant on Quarry Hill. Current is being supplied by the Westerly Light and Power Company.

Electricity to Aid Mine Development.

A recent dispatch from Cobalt, Ont., states that an electric power plant is being planned to aid in the development of the mining claims recently located near the Mattagami River.

Exports of Copper.

The metal exchange reports total exports of copper for the week ended July 21, 5,132 tons; since the first of the month 15,475 tons; last year, 26,617 tons.

RETARDATION TESTS OF ELECTRICAL MACHINES.

BY F. W. HERLAN.

Not the least important among the determinations to be made when testing dynamo machines is the calculation of the factor tending to increase the rotative torque which must be applied by the prime mover, due to internal restriction. We know that a mass of iron rotating in a magnetic field suffers retardation from three causes, namely, first, the action of the eddy currents set up in the mass of iron, upon the field; second, the magnetic hysteresis, and third, bearing losses, windage, etc.

The torque necessary to maintain motion in a generator running light, with the field fully excited, must balance the retarding torque set up by the three causes enumerated above. The first two are usually designated as core loss and the third as friction loss. With a constant field excitation, the retarding torque due to the first cause is proportional to the speed of the machine; that due to the second cause is constant for all speeds; and that due to the third cause is a very uncertain variable.

In machines where the windage is practically negligible, the friction may be taken as a constant between the limits of speed to which it is proposed to confine the tests. In the case of turbosets, however, the question of windage is a very important factor, and it is found necessary to divide the frictional losses into two component parts. The first, dealing with bearing friction, is regarded as constant for all speed values, and the second, comprising the loss due to windage alone, increases approximately as the cube of the speed.

With small machines, having comparatively small masses of rotating iron, the core and friction losses can easily be determined by driving the machine under test with an auxiliary motor at constant excitation, and if possible directly connected to the test machine. If a belt connection be used, theoretically the belt loss should be taken into account, but if the proper conditions are maintained—that is, a fair length of drive with the pulleys not too small—this loss can be neglected. By noting the input corresponding to the various excitations of the generator the losses can be computed as follows.

Supposing the watts and armature current of the auxiliary when running light at the normal speed of the test machine, to be represented by W and I respectively; and when driving the generator at its normal speed—not excited—by W_1 and I_1; and again, with the full exciting current on the machine under test by W_2 and I_2; then, denoting the resistance of the motor armature by R,

$$\text{Friction Loss} = W_1 - I_1^2R - (W - I^2R)$$
$$= W_1 - W - R(I_1^2 - I^2)$$
$$\text{Core Loss} = W_2 - I_2^2R - (W_1 - I_1^2R)$$
$$= W_2 - W_1 - R(I_2^2 - I_1^2)$$

With large machines, having comparatively large masses of rotating iron, the friction and core losses may be determined by accelerating the machine up to its normal speed, cutting off the driving force, and plotting the velocity curve as it comes to rest, corresponding to various conditions imposed upon the machine, the principle being that the retarding torque acting on the rotating mass is proportional to the angular deceleration at any particular instant.

Let n = the deceleration in revolutions per second per second; then $2\pi n$ = the angular deceleration which may be designated by α.

The moment of inertia of a rotating body, represented by $J = M k^2$, when M is the mass, and k the radius of gyration in feet. The torque, using as a symbol, $T = J\alpha$, and $M = w/g$. One may therefore write:

$$T = \frac{2\pi n}{32.2} wk^2 \text{ in pound-feet.} \qquad (1)$$

From now on, J will be taken as being equal to $w.k^2$. The chief concern is with the power required to exert the torque, and the power $P = 2\pi NT$, if at the point where the angular deceleration is denoted by α the speed is N revolutions per second. Hence

$$\text{Watts} = \frac{T \times 2\pi N \times 60 \times 746}{33000}$$
$$= \frac{(2\pi)2N \times 60 \times 746}{33000 \times 32.2} J n$$
$$= 1.662 N J n \qquad (2)$$

which represents the rate at which energy is dissipated by the losses occurring in the machine, at the particular instant being considered.

It is the usual practice to obtain curves corresponding to the following conditions: (a) no field; (b) normal

field; (c) several intermediate values of the field current; (d) with a small external load, usually ten to fifteen per cent of the full load, working with as small a field as is practicable; (e) in the case of alternators, with the armature short-circuited, full load current in the windings, and then with varying values of the current above and below the full load value.

The curves are plotted with the time in seconds for the abscissa, and revolutions per minute for the ordinates. If it is desired to ascertain the loss in watts when the machine is running at its normal speed under any of the above conditions, a tangent is drawn to the curve at the point corresponding to this speed. Having the velocities corresponding to the time, and deceleration being the rate of decrease of velocity with respect to time, then taking a revolution per second as the unit of velocity:

$n = \frac{dv}{dt}$ = the slope of the curve, which is the tangent that has been drawn.

$= \tan \theta$ where θ is the angle the slope makes with the abscissa.

$= \frac{a}{60b}$ where a is the value of the ordinate, and b the value of the abscissa.

Everything necessary to solve equation (2) is now known, except J, and this can be determined in several ways, of which there are three in most common use.

MOMENT OF INERTIA.

Method No. 1.—The moment of inertia of a rotating mass is the sum of the differential masses multiplied by the square of their radii.

Consider the case of an alternator rotor. It consists essentially of numerous poles placed around the periphery of the rim, the rim itself, the arms and the shaft. Assume the poles as concentrated masses, with radii measured from their centers of mass; then if W represents the total weight of each pole, r_p the radius, and m the number of poles:

$$J = W.\, r_p^2.m.$$

In considering the rim of weight W_1, let the inside and outside radii be r_1 and r_2, then

$$J = \frac{W_1}{2}\left(r_2^2 + r_1^2\right)$$

The moment of inertia of the shaft is equal to $W_3r^2/2$ where W_3 is the weight of the shaft, and r is the outside radius.

With the average spider, having six or eight arms, it has been found that a very near approximation is given by assuming that the weight of the arms, which may be called W_2, is so distributed that one-third of the total can be considered as concentrated around the radius of gyration of the rim, and consequently if this amount be added to the weight of the rim a figure near enough for all practical purposes will be obtained, and much unnecessary calculation will be obviated.

Collecting the individual moments, one may now say that the moment of inertia of the whole rotor is given by the following formula:

$$J = W.\, r_p^2.m + \left(W_1 + \frac{W_2}{3}\right)\frac{\left(r_2^2 + r_1^2\right)}{2} + \frac{W_3 \cdot r^2}{2}$$

Method No. II.—This is a simple method, applicable to direct-current motors and generators, and is carried out by running the machine as a motor with normal field excitation, taking notes of the armature current, the volts and speed.

If N = speed in revolutions per second, R = resistance of the armature in ohms, then the power in watts required to overcome the internal losses is represented by

$$IE - I^2R$$

Using the curve in the same manner as previously, and again taking n as the deceleration in revolutions per second at the given speed, by equation (2) we have at any moment:

Watts = 1.662 N.J.n = $IE - I^2R$

Therefore:

$$J = \frac{IE - I^2R}{1.662\ N.n}$$

Method No. III.—This method is a function of test (d) mentioned earlier, and is obtained from the deceleration curve corresponding to a definitely applied electrical torque. Although not so accurate as other methods, it is quite accurate enough for all practical purposes, and considering the ease and rapidity with which the test can be made it is by far the most satisfactory, and is particularly suitable for turbo-alternators where other methods are laborious.

In Fig. 1 are shown three representative curves taken on a 1000-kilowatt turbo-alternator, corresponding to conditions (a), (b) and (d) mentioned previously.

(a). No Field: In this case the retarding torque is that due to windage, friction, etc., and may be written:

$$T = f + kN^m = \frac{2\pi}{32.2} Jn_1$$

where f is the torque due to friction, and kN^m is that due to windage or other variable cause, N^m being a power of the speed N.

Therefore,

$$Jn_1 = \frac{32.2\,(f + kN^m)}{2\pi}$$

$$\text{or, } Jn_1 = F + KN^m \qquad (3)$$

$$\text{where } F = \frac{32.2\,f}{2\pi}$$

$$\text{and } K = \frac{32.2\,k}{2\pi}$$

(b). Normal Field: In addition to the retarding torque expressed above, there is under this condition a torque due to hysteresis loss, which is a constant for all speeds, and which may be denoted by h. There is also a torque due to the eddy current loss, which is proportional to the speed and which will be designated by aN. Therefore, at any instant

$$Jn_2 = F + KN^m + H + AN \qquad (4)$$

$$\text{where } H = \frac{32.2\,h}{2\pi}$$

$$\text{and } A = \frac{32.2\,a}{2\pi}$$

(d). Small Auxiliary Load: With the small auxiliary load a known torque is brought into effect which can be calculated from the load in watts. Taking the formula from which equation (2) is derived, and transposing

$$T = \frac{W \times 33\,000}{2\pi N \times 60 \times 746} = \frac{.1175W}{N} \text{ where W = watts}$$

This torque will of course vary with the speed, as the resistance will remain constant. Let this auxiliary torque be expressed by sN, then for any instant

$$Jn_3 = F + KN^m + H + (A+S)N \qquad (5)$$

$$\text{where } sN = \frac{.1175\,W}{N} \text{ and}$$

$$S = \frac{32.2\,s}{2\pi} = \frac{0.602\,W}{N^2} \qquad (6)$$

For the purposes of equation (5) it has been assumed that the field value is normal as in case (b), otherwise the Constants A and H will be different from those in equation (4). Working, however, as in practice, with a very small field, the core losses may be neg-

lected, as they decrease practically as the square of the flux density, and therefore equation (5) may be modified to:

$$Jn_3 = F + KN^m + SN \qquad (7)$$

By subtraction of equation (3) from (7)

$$J = \frac{SN}{n_3 - n_1} = \frac{0.602\ W}{N(n_3 - n_1)}$$

The calculation of the various losses may now be proceeded with.

COMPUTATION OF LOSSES.

Friction and Windage Loss. From the curve corresponding to condition (a), in Figure 1, the deceleration at

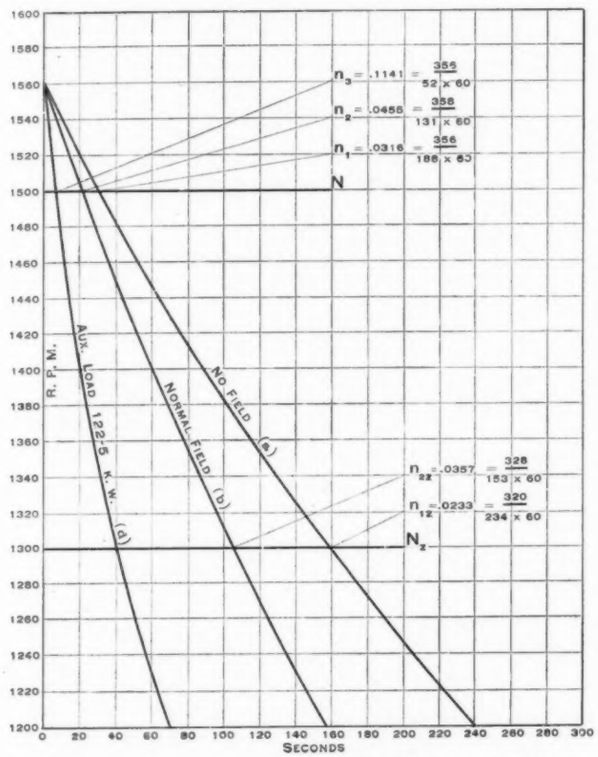

R. P. M.
SECONDS
N
N_z
$n_3 = .1141 = \frac{356}{52 \times 60}$
$n_2 = .0458 = \frac{356}{131 \times 60}$
$n_1 = .0316 = \frac{356}{188 \times 60}$
$n_{2z} = .0357 = \frac{328}{153 \times 60}$
$n_{1z} = .0233 = \frac{320}{234 \times 60}$
AUX. LOAD 122.5 K.W. (a)
NORMAL FIELD (b)
NO FIELD (c)

FIG. 1.—VELOCITY CURVES OF CURTIS TURBO-ALTERNATOR.

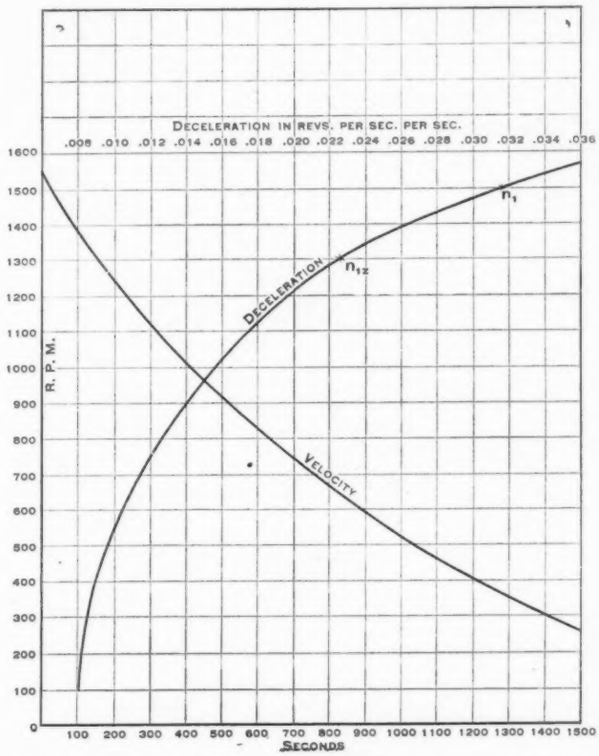


FIG. 2.—DECELERATION AND VELOCITY CURVES OF CURTIS TURBO-ALTERNATOR.

is not a difficult matter to segregate the losses thus far obtained into their component parts, as will be shown.

In Figure 2 the actual deceleration on a 1000-kilowatt turbo-alternator has been plotted in revolutions per second per second. It will be seen that below a certain point the curve remains practically constant for all values of the speed, this portion being proportional to the constant frictional torque. Above a certain value the curve changes rapidly with the speed owing to the windage, and is found upon analysis to conform to the equation $x = ky^3$.

speed N can be obtained, and designating this as previously by n_1, then from equation (2)

$$\text{Watts} = 1.662\ N.J.n_1$$

Core Loss. From the curve corresponding to condition (b), see Figure 1, again calculate the deceleration n_2 and by equation (4)

$$Jn_2 = F + KN^m + H + AN$$
$$= Jn_1 + H + AN$$

therefore

$$J(n_2 - n_1) = H + AN$$

and

$$\text{Watts} = 1.662\ N.J(n_2 - n_1)$$

From a practical standpoint this is all that is required, but if desired it

Knowing this, at speed N equations (3) and (4) can now be written,

Case (a): equation (3)

$$Jn_1 = F + KN^3 \qquad (8)$$

Case (b): equation (4)

$$Jn_2 = F + KN^3 + H + AN \qquad (9)$$

Now let the speed drop to N_z, then Jn_1 decreases to Jn_{1z} and Jn_2 decreases to Jn_{2z}, and in

$$\text{Case (a)}\ Jn_{1z} = F + KN_z^3 \qquad (10)$$

$$\text{Case (b)}\ Jn_{2z} = F + KN_z^3 + H + AN_z$$

Subtracting equation (10) from equation (8)

$$J(n_1 - n_{1z}) = K(N^3 - N_z^3)$$

$$\text{Therefore}\ K = \frac{J(n_1 - n_{1z})}{N^3 - N_z^3} \qquad (12)$$

Again, subtracting equation (11) from equation (9)

$$J(n_2 - n_{2z}) = K(N^3 - N_z^3) + A(N - N_z)$$

then by substitution

$$J(n_2 - n_{2z}) = J(n_1 - n_{1z}) + A(N - N_z)$$

$$\text{and}\ A = \frac{(n_2 - n_{2z}) - (n_1 - n_{1z})}{N - N_z} J \qquad (13)$$

Windage Loss. It has already been seen that the retarding torque due to this cause is equal to kN^3; expressed in pound-feet, it becomes from equation (12) equal to:

$$\frac{2\pi}{32.2} \frac{(n_1 - n_{1z})}{(N^3 - N_z^3)} J.N^3$$

and from equation (2):

$$\text{Watts} = 1.662 \frac{(n_1 - n_{1z})}{(N^3 - N_z^3)} J.N^4$$

Eddy Current Loss. The retarding torque due to this loss is denoted by aN; expressing this also in pound-feet,

$$\text{Torque} = \frac{2\pi}{32.2} A.N$$

and from equation (13) this is equal to:

$$\frac{2\pi}{32.2}\ \frac{(n_2 - n_{2z}) - (n_1 - n_{1z})}{N - N_z} J.N$$

and again from equation (2)

$$\text{Watts} = 1.662\ \frac{(n_2 - n_{2z}) - (n_1 - n_{1z})}{N - N_z} J.N^2$$

Constant Friction: This of course can now be ascertained by subtracting the windage loss from the friction and windage loss.

Hysteresis Loss: In the same way this equals the core loss, minus the eddy current loss.

It is necessary in making these calculations to have N—N_z fairly large, at least fifty per cent, and it is almost superfluous to add that the decelerations should be observed with the utmost accuracy.

Before concluding, let case (e) be considered, where alternators are being dealt with. By short-circuiting the armature, one is enabled to determine the copper loss in the windings at full load, as the retarding torque due to this short-circuit current will be proportional to I^2R, where I is the circulating current and R is the resistance of the armature.

With a short-circuit current equal to the full load current, call the deceleration corresponding to a speed N, as before, n_4, then as the field in this case will be weak, the core loss may be neglected, and

$$\text{Torque} = \frac{2\pi}{32.2}.(n_4 - n_1) J$$

and full load copper loss $= 1.662\ (n_4 - n_1)\ JN$ in watts.

NUMERICAL EXAMPLE.

The following calculations from a test taken on a 1000-kilowatt, 6600-volt, 1500-revolutions-per-minute, Curtis turbine show the application of the foregoing methods. The curves shown in Figure 1 corresponding to cases (a), (b) and (d) were made from this test.

$N = \frac{1500}{60} = 25$ and $N^3 = 15625$

$N_z = \frac{1300}{60} = 21.67$ and $N_z^3 = 10180$

$n_1 = .0316$

$n_{1z} = .0233$

$n_2 = .0455$

$n_{2z} = .0357$

$n_3 = .1141$

The auxiliary load used was 122.5 kilowatts.

$$S = \frac{0.602\ W}{N^2} = \frac{0.602 \times 122500}{625} = 118.2$$

$$J = \frac{SN}{n_3 - n_1} = \frac{118.2 \times 25}{.0825} = 35820 \text{ pound-feet}^2$$

Friction and Windage Loss.

$$\text{Watts} = 1.662\ N.J.n_1$$
$$= 1.662 \times 25 \times 35820 \times 0.0316$$
$$= 47032 \text{ or } 47 \text{ kilowatts.}$$

Core Loss.

$$\text{Watts} = 1.662\ N.J.(n_2 - n_1)$$
$$= 1.662 \times 25 \times 35820 \times 0.0139$$
$$= 20686 \text{ or } 20.7 \text{ kilowatts.}$$

Separation of Losses. *Windage Loss:*

$$\text{Watts} = 1.622\ \frac{n_1 - n_{1z}}{N^3 - N_z^3}\ J\ N^4$$

$$= \frac{1.662 \times 0.0083 \times 35820 \times 3.91 \times 10^5}{5445}$$

$$= 35.5 \text{ kilowatts}$$

Eddy Current Loss:

$$\text{Watts} = \frac{1.662\ (n_2 - n_{2z} - n_1 + n_{1z})\ J.N^2}{N - N_z}$$

$$= \frac{1.662 \times 0.0015 \times 35820 \times 625}{3\,33}$$

$$= 16.8 \text{ kilowatts}$$

Constant Friction:

$47.0 - 35.5 = 11.5$ kilowatts.

Hysteresis Loss:

$20.7 - 16.8 = 3.9$ kilowatts.

In conclusion, the writer wishes to express his indebtedness to Martin P. Rice of the General Electric Company, and A. P. Young of the British Thomson-Houston Company, for curves and data incorporated in this article.

Canadian Prosperity.

The wonderful growth of the Dominion of Canada is made apparent in the following general statistics, compiled by Consul A. G. Seyfert, of Owen Sound.

The clearing houses of fourteen leading cities of the Dominion for 1909 showed a total transaction of over five billion dollars. The banks have a total paid-up capital of 100 millions, a reserve fund of nearly eighty millions, notes in circulation eighty-two millions, deposits aggregating nearly 900 millions, and assets of over one billion. In less than fifteen years the exports of wheat from Canada to the British Empire have grown from nine million bushels to forty-six millions, and the exports to other countries in the same time from nine to fifty million bushels.

The total agricultural development for the year 1909 was thirty million acres of land, yielding crops valued at 532 millions of dollars. This was an increase of over 100 million dollars over the previous year. During 1909 Canada imported goods to the value of 300 million dollars, two-thirds of which came from the United States. The exports reached 244 millions, of which Great Britain took 127 millions and the United States eighty-five millions. The silver production for 1908 was eleven millions, and that of copper, nickel and cobalt twenty-five millions.

During the same year the electric railroads transported 300 millions of people and 730 thousand tons of freight on 11,000 miles of track. The electric roads showed earnings of fourteen million dollars and working expenses of eight millions on a capital of eighty-eight million dollars. The steam railways, with 23,000 miles of track, carried thirty-four million passengers and sixty-three million tons of freight, at an earning of 147 million dollars on a capitalization of one and a quarter billion dollars.

During 1909 the number of declared settlers who arrived in Canada was 152,071. Of this number 72,349 came from the United States, 47,580 from the United Kingdom, and the rest from other countries.

A Large City Electric Sign.

At Phillipsburg, N. J., there has been erected a large electric sign bearing the city's name in letters six feet high by three feet wide. The sign is mounted on top of a building in plain view of all the five railways that pass through the city. The full length of the sign is fifty-five feet and it is lighted every evening from sunset to midnight.

Tree Felling by Electricity.

A new method of felling trees by electricity is reported from Germany. A steel wire one millimeter in diameter is actuated by an electric motor and cuts into the trunk by its own friction without the aid of wedges. A tree twenty inches in diameter was cut down in six minutes by the new process.

MICHIGAN ELECTRIC ASSOCIATION.

MEETING AT PORT HURON, MICH., AUGUST 16-18.

The seventh annual convention of the Michigan Electric Association was held at the Hotel Harrington, Port Huron, Mich., August 16 to 18. About one hundred members were present, and while this number was comparatively small, the meeting was, in point of interest, one of the best that the association has ever held. All of the papers which were read were prepared by men of considerable experience in central-station work and the results to which they refer are based upon practical knowledge. Abstract theory was, for the greater part, avoided.

On Tuesday evening, August 16, the convention was formally opened by Mayor John Bell, who welcomed the members of the Association to Port Huron, Mich. Mr. Bell, after congratulating the officers on securing the convention for this place, called the attention of his hearers to the many points of interest which might be seen in connection with the work of the convention. Hon. Henry McMorran, who was also to have welcomed the members, was unfortunately unable to be present. The meeting was, however, addressed by J. C. Sloan, manager of the Port Huron Gas Company. Among other things, Mr. Sloan remarked that while he, as a gas man, might be expected to be the natural enemy of electricity, this was not the case. The two interests are united, in so far as they are both serving the public. There is keen competition, but this is to the benefit of the companies as well as the public. The person using a public utility, as a general thing, has too little a field for selection, and should be well treated by the company with which he deals. Disregard of his interests must invariably bring the company into disrepute. No company is doing business for the sole benefit of the public, but as a rule consideration is not expensive and the customer is generally willing to pay a fair price for power. Fairness to the company's interests is compatible with regard for the consumer, and it is quite possible to get a fair return on investment and still have satisfied customers. Too many companies make the mistake of showing dividends earned rather than dividends paid, which is an error that will sooner or later cause trouble. Depreciation is too important to be neglected.

In closing his remarks, Mr. Sloan extended a cordial invitation to members to visit the office and works of the Gas Company.

PRESIDENT'S ADDRESS.

A. C. Marshall, in his presidential address, made a number of suggestions which had come from his observation of conditions, and recommended several changes in Association matters. In speaking of membership, he made the statement that fully eighty-five per cent of the membership of the association came from towns of 5,000 to 10,000 population. It is important to remember this. With regard to lighting, a great many companies are coming to an appreciation of series tungsten lamps for street lighting, but the field is much broader than is commonly supposed. A combination of flaming arc lamps with tungstens might be devised, and this, he believes, would be ideal. Turning toward the politics of the Association, Mr. Marshall remarked that he thought the present two-year term of the president too long and suggested that hereafter this official should hold office but one year. As to the time of meeting, many are in favor of winter sessions, stating that it is almost impossible to get away in summer. This matter should be taken up for consideration. He also recommended that some official badge should be adopted. As the treasury becomes stronger, it might be well to purchase apparatus which could be loaned to members. Such instruments as a carbon-dioxide recorder, curve-drawing wattmeters, etc., which are too expensive for a small company to own, might be of great advantage to the Association.

At the close of Mr. Marshall's remarks a motion was made to appoint a committee of three to consider his suggestions.

WEDNESDAY SESSION.

The Wednesday morning session of the convention was opened by a paper by H. F. Rosenkrans, dealing with boiler room practice in central stations operating in small or medium sized towns. An abstract of Mr. Rosenkrans' paper, containing the principal points which he made, follows:

THE BOILER ROOM AND ITS CONTENTS.

In the first part of Mr. Rosenkrans' paper attention is called to the value of making tests of the boilers. In many instances they show up faulty equipment or careless operation and indicate how the fuel bills may be reduced ten to thirty per cent or even more. A very common trouble is from the use of boilers of too small capacity. Careless firing is probably the most prolific cause of poor economy and high repair bills. The author pointed out numerous features that should be incorporated in the specifications for the purchase of the boilers. He gave many valuable hints on the layout of the piping both on the steam end and on the boiler feed. Boiler-feed pumps and feed-water heaters were discussed, also precautions to be observed in firing, blowing-off and cleaning, changing over boilers and other points of operation

The discussion which followed the reading of this paper touched on many points intimately concerned with power-plant practice. Mr. Marshall's statement that the association should look after the smaller stations was supported by H. A. Chase, who also said that there were several tests which should be made by a man, who is taking charge of a new plant. He should investigate the water and coal consumption with the utmost care. As the cost of current will depend largely on the way the firing is done, the firemen should be watched and checked if possible. A recording steam meter makes an excellent check and at the same time encourages the fireman in keeping down his steam and coal consumption. Daily records are most important and are generally kept. Sometimes a plant is found to be in such bad condition that profitable operation is practically impossible. Still the company wonders why the concern is operating at a loss.

Very often no proper allowance is made for the expansion of a plant and new engines are added with no increased boiler capacity. Consequently the boilers are simply forced until they take care of the load.

Mr. Marshall agreed that while nearly all central stations do keep adequate daily coal records, few keep a record of water consumption. Hardly any of the smaller concerns have any records of the furnace gases. Of course there is some difference of opinion as to what sized plants can afford carbon-dioxide recorders, but it does not seem necessary for those with a coal consumption of less than twenty or twenty-five tons per day.

A. N. Richardson, of Ann Arbor, in answer to a question, spoke briefly on the use of oil burners. In the Ann Arbor plant, these are used merely to

supplement the waterpower installation. Crude oil is very satisfactory in this case, but it can not compete with coal in long runs.

J. R. Cravath raised a question as to whether boilers might not operate at a greater efficiency if they were forced to a certain extent, a condition which Mr. Chase had previously stated was always objectionable. In the opinion of John Cavanaugh, there is a point in either direction which should not be passed.

Mr. Hemphill raised an interesting question as to the proper method of purchasing coal and the growth of the use of this price basis. He referred to the scheme of buying on a British-thermal-unit basis. Large companies have already changed to this method and the consequence is that the smaller companies get the poorer coal by the ton. Any arrangement by which members of the Association could have their coal tested before buying, would be most welcome to the smaller plants.

Following the discussion of Mr. Rosenkrans' paper, F. B. Spencer, of Cheboygan, read a paper on central-station accounting. Mr. Spencer's paper is given in part below.

ACCOUNTING FOR SMALL CENTRAL STATIONS.

This paper refers to central-station statistics which show the large number of central stations operating in small towns. In Michigan alone eighty per cent of the stations are to be found in towns of 12,000 or less. In matters pertaining to their accounting systems most of the small companies have failed, in the past, to understand the principles of accounting and to appreciate the importance of their careful application. The paper emphasized the growing need for uniform systems of accounting and outlined the system presented by the committee of the National Electric Light Association. This may be divided into the following general heads: Income; expense; distribution; commercial; general; plant and equipment; stock accounts; balance sheets; and liabilities. The necessary books for use with this outline of account should comprise a ledger, cash book and journal. The paper itemizes the entries to be made in each book, according to classification and concludes with several samples of typical pages.

Thomas Hinks, in discussing this paper, suggested that an accounting scheme be arranged and forms drawn up for small central stations. This would give a good basis for comparison at future conventions. Such a step Mr. Richardson thought unnecessary, as this has already been well provided for by the various public service commissions. In mentioning the complications of public-service accounting Mr. Cavanaugh stated that his plant had more than one hundred separate accounts, all of which must be reported every month to the state authorities. The best point about this is that as long as he must inform the Commission, the plant manager will always have the exact figures regarding his plant at his fingers' ends.

A paper by F. R. Mistersky, on the "Real Cost of Street Lighting," followed. In Mr. Mistersky's absence his paper was read by Mr. Biggs.

THE REAL COST OF STREET LIGHTING.

It is often impossible to gain much information from the comparison of the real costs of operating an electric plant, inasmuch as the accounts are kept differently. With the intention of securing greater uniformity several states have through their public service commissions devised uniform accounting systems. This is necessary for state regulation. The items that should be included in a lighting account are as follows: Operating cost, for fuel, water, boiler room supplies, lubricants, waste, packing and miscellaneous supplies, wages and salaries, cost of repairs of buildings, steam and electric plant, lines and cables, meters, transformers, arc lamps and other apparatus required in the production or distribution of the output of the plant, also a proper proportion of salaries and office expense. Interest on investment cannot, in equity, be charged to the cost of lighting.

The actual life of the apparatus has not been determined nor can this be arrived at with any great degree of accuracy. Taxes and insurance are part of the lighting cost, and proper allowance should be made for these expenditures. When some incidental revenue is received this should be credited to lighting. In some smaller towns plants are composite; being either gas and electric light or electric light and water. These plants should show creditable results from both departments.

One of the points brought out in the discussion, by Mr. Cavanaugh, was that the real cost of municipal street lighting was in many cases not what was given. Too often the authorities do not take into consideration the taxes, depreciation, or anything except the bare running expenses. This is not done with the intention of deceiving the public, but it often has this effect. Mr. Cravath cited the case of some person, who had been making a trip through small towns with the intention of installing municipal lighting plants. He promised that they would run at an expense of $35 per arc light per year. Such a low charge is out of the question, when all expenses are considered. The question of a proper depreciation allowance was discussed briefly.

The discussion was followed by John Cavanaugh's paper on "Baking Enamel by Electricity," an abstract of which follows:

BAKING ENAMEL BY ELECTRICITY.

Mr. Cavanaugh's paper recounted some experiments made by the Baker-Vawter Company in the building of electrically heated ovens for baking enamel. At first five ovens each 5 by 7 by 9 feet were built with triple walls inclosing a double air space for heat insulation. Various types of heating coils placed at different portions of the oven walls were tried. After a series of trials it was found that with four coils in use it was possible to raise the temperature to 250 degrees Fahrenheit in one hour; this had to be maintained practically four hours, which required the expenditure of 46.8 kilowatt-hours. A later type of oven was built with dimensions 6.5 by 8 by 8.5 feet and having triple hardwood walls with asbestos paper between the layers of boards and a half-inch lining of asbestos. Both inside and outside the oven was covered with polished tin. Four heating coils were used and the temperature was raised to 210 degrees in one hour; it was maintained there, however, with the use of two coils only, and the energy consumption for the entire baking was 16.2 kilowatt-hours, only about one-third as much as in the former ovens. Six ovens are installed, at least three being in operation. They are fed with 110-volt current from a three-phase circuit, two adjacent ovens being on the same phase and one baking while the other is being emptied and refilled. The energy for this service is supplied at two and one-half cents per kilowatt-hour.

Mr. Cavanaugh showed a number of samples of enameled iron which had been baked in his ovens and also exhibited a photograph of the heating coils. These are made of No. 14 iron telephone wire wound in spirals. The company which he represents is also considering supplying baker's ovens with current, but has not gone into this field as yet.

THURSDAY SESSION.

The Thursday morning session opened with a paper by R. S. Stewart on "Flat Rates for Residence Lighting." Mr. Stewart's paper, in which he upholds the flat rate for the small central station, is given here in part.

FLAT RATES FOR RESIDENCE LIGHTING.

This paper reviews the conditions that has led to the present system of charging for current, which the author anayizes as being the combination of the old flat-rate system based on the maximum demand with meter rates based on the total electric consumption as measured by meter. This meter system of charging according to the auditor is not looked upon very favorably by customers in smaller towns. It is stated that many non-users of current would use electricity in preference to other illuminants if their bills could be limited to fifty cents of $1.00 per month. When it is considered that this amount per month is required to pay for interest and depreciation and maintenance of a meter and the cost of reading the same it is readily seen that small customers are not profitable to a company which charges for service by meter. The paper pointed out that such small services on the other hand on flat-rate system bring in a profit proportional to the amount of service. With a system of flat-rate charges, together with an optional meter rate, it is possible to obtain, according to the author, seventy-five per cent or more of the total of both business and residence lighting of a small town. Considering a station in a town of 2,500 people as typical the author points out that the meter rates that he assumes to be fifteen cents per kilowatt-hour for the first fifty hours and five cents for all consumption in

excess of fifty hours, show no profit for the small fifty-hour consumer and only thirty cents profit for the small 150-hour customer, while the flat-rate system shows a small profit for the fifty-hour consumer and a correspondingly larger profit for the 150-hour customer. One of the main arguments advanced by the author in favor of flat rates is that the average customer prefers to pay a fixed monthly bill rather than pay a variable bill depending upon the reading of some meter, concerning which he knows nothing and which he believes to be adjusted in favor of the company. The author is of the opinion that flat-rate lighting with tungsten lamps is more satisfactory than any other system of charging in a small town. The customer who buys his tungsten lamps and pays the high price of these, does not wish to buy new lamps except when necessary and he will turn off all lamps which he is not using. This will reduce the number of hours use of the load paid for. It is very satisfactory, however, to so adjust the rates for tungsten lighting that the price of one new tungsten lamp per year is included in the flat rate. The proper charge for flat-rate tungsten lighting depends on local circumstances but a rate of one and one-quarter cents per month per watt, less ten per cent for cash, should be sufficient to cover all costs and pay for the renewal of one lamp per year for each lamp installed.

A. T. Holbrook, of the Excess Indicator Company, opened the discussion by calling attention to the desirability of this rate from the standpoint of the customer. Many customers would like at least to know that their bills will not exceed a certain amount. There is a wide difference between the old flat rate with which the customer may impose upon the company, and the new flat rate with current-limiting devices. It is a great advantage to a central-station solicitor to be able to tell the price of the commodity at the same time he tells of its convenience and advantages. There are at present many people who hesitate about changing to electric light on account of the cost. This objection would be entirely overcome if it were possible to give them the price in terms of so much per month. In closing, he emphasized the high income which some plants had obtained through the use of the flat rate with current-limiting devices.

An objection to this flat rate was made by F. L. Prindle, who had tried it without the current-limiting device. In his case the customers not only substituted sixty-watt lamps for the forty-watt size but, with the assistance of other electricians, added new lamps to the circuit. Naturally this was highly unsatisfactory. Following this several cases were cited where money was being lost by the use of the flat rate. Mr. Prindle raised the point that the moment discrimination comes in there is trouble; and discrimination does come in when one man burns his lights for twice the time of his neighbor and yet pays the same price.

The standpoint of Mr. Stewart was taken by Mr. Williams, of the National Electric Lamp Association, who gave a few experiences which he once had in soliciting lighting business. He stated, among other things, that many people of the working classes would have taken power if they had known just how much to put aside each month to pay the bill.

In further support of the flat rate, Mr. Holbrook read a letter from a western central-station man. In this case a flat rate of eighty-five cents per month for each fifty-watt lamp had been used at first. Later this was changed to eighteen cents per kilowatt-hour. Formerly the plant was making money, while at present it is operating at a loss. This gives the definite results of a plant that has tried both systems.

The line of this discussion was followed out in a paper on "The Cost of High Efficiency Lighting," read by Mr. Williams.

It is beyond doubt that the advent of the high-efficiency lamps caused considerable disturbance among the central-station managers. There was a great fear of reduced incomes, which fortunately proved to be groundless. There is naturally a tendency toward smaller lamps for residential lighting, but this is more than balanced by additional users. The high-efficiency lamp is, beyond doubt, here to stay. The fragile nature of the tungsten filament was at first its greatest drawback, but greater strength is being attained in each new type of lamp. It is quite natural that the use of these lamps should be accompanied by a revision in rates, but this need not cause a decrease in income. At times it is a good thing to serve customers at an actual loss. One case of this would be in a plant of too large capacity. Another possible case would be that of a new station which was securing a load. Of course such methods as these tend to penalize the better class of customers. Rates in the past have been based largely on what the public would stand, or what the company considered would make a reasonable profit. The total cost of operation might be considered as the sum of a fixed cost and a cost which depends entirely upon the customer. This would be the sum of three things: (1) Customer's cost; (2) Demand cost; (3) Output cost. These items vary considerably in different plants, for the demand charges are larger in smaller towns, while the distribution charges are larger in the larger cities. The diversity factor might be expected to become smaller as the station expands. Regarding the flexibility of the flat rate, Mr. Williams cited the case of Hartford, Conn., which employs that method of charge. In that city each customer is permitted to exceed his load one night per month, provided he notifies the company in advance. The limiting device is then removed, permitting the customer to light his house for a party. This has been found to be very satisfactory.

A paper on "The Maintenance of Meters in Small Towns," by A. M. Richardson, of Ann Arbor, followed.

MAINTENANCE OF METERS IN SMALL PLANTS.

After discussing the necessity and possibility of maintaining meter accuracy, the author went on to advocate the systemization of the work in order to actually realize accuracy. The work should be in the hands of a specialist with a room set aside for the sole purpose of storing and testing meters. The use of a rotating standard and a portable load is advocated, with an indicating wattmeter for checking the standard. Smaller companies may check it by sending to the factory, a test bureau or a larger company. Good practice designates sixty per cent of the connected load of a residence as the proper capacity for a meter and 100 per cent on business premises. Suitable printed forms should be provided for recording results and monthly reports should be drawn up showing time expended on the work, number of meters tested, number fast and slow and the amount of the errors. The labor cost of testing a meter is twenty-five cents.

Owing to the fact that the meeting was pressed for time the discussion of Mr. Richardson's paper was waived. A paper on tungsten lamps, by Thomas Hinks, of Mt. Clemens, was then read, and is given in abstract below.

TUNGSTEN LAMPS IN MT. CLEMENS.

Prior to the advent of the tungsten lamp the central station in Mt. Clemens had some fifty-five series direct-current arcs in service for various customers on a flat-rate basis of charging. As these were very unsatisfactory they were replaced early last year by two and three-light fixtures equipped with shades and 100-watt tungsten lamps. Since that time the business has steadily increased, until now ninety per cent of the business places in the city are electrically lighted by the company. There are not over sixteen per cent of its customers who do not make use of tungsten lamps. Within a year fifty gas "arcs" and ten gasoline plants were replaced by tungstens. The flat-rate basis of charging was changed to the meter system. A number of 500-multiple arcs were also replaced with tungsten lamps. Several of the old arc-lamp bodies were utilized by removing the carbon holders and mounting three ordinary sockets in which sixty-watt tungstens were placed, thus forming what were called 180-watt tungsten arcs. The sixty and 100-watt tungsten lamps have averaged about 950 hours of useful life. Early troubles from careless handling and burnouts have been reduced greatly and in every way the lamps have given excellent satisfaction.

EXECUTIVE SESSION.

In the executive session which followed the reading of the paper, the nominating committee, composed of F. B. Spencer, Howard Pett, and A. N. Richardson, announced the nomination of officers for the coming year. These officers will be as follows: President, John Cavanaugh, Benton Harbor; vice-president, F. B. Drees, Lansing; secretary and treasurer, Herbert Silvester, Detroit. The executive committee, which was then announced, will be composed of the following members: O. S. Wood, J. De Young, and H. A. Fee.

Following the reading of the secretary's report, the meeting closed with a talk by J. F. Oxtoby on the "Present Aspect of Legal Affairs in the State."

REGISTRATION LIST.

A list of the members and associates present at the convention is given below.

CENTRAL STATION MEMBERS.

J. V. Oxtoby, Detroit; Hoyt E. Allen, Oxford; Eber Arnold, Marine City; W. M. Barron, St. Clair; A. P. Biggs, Detroit; D. H. Beardsley, Battle Creek; Mrs. J. W. Brennan, Detroit; H. A. Chase, Hart; Thos. Currie, Port Huron; E. L. Crosby, Detroit; John A. Cavanaugh, Benton Harbor; R. T. Duncan, Detroit; B. F. Desnoyer, Lapeer; F. B. Drees, Lansing; Miss M. L. Ewing, Detroit; A. D. Furlong, Pontiac; Mr. and Mrs. W. H. Friedrich, Coldwater; N. V. Gerrish, Cadillac; B. K. Goodman, Reading; R. W. Hemphill, Jr., Ann Arbor; T. L. Hinks, Mt. Clemens; C. D. Hulbert, Lapeer; Mrs. J. C. Hoetger, Mt. Clemens; B. J. Lawrence, Marine City; A. C. Marshall, Port Huron; Mr. and Mrs. F. G. McNutt, Port Huron; H. A. Mott, Jackson; Chas. McEachern, Port Huron; W. E. Murchey, Birmingham; C. C. Munroe, Detroit; Howard Pett, Big Rapids; F. L. Prindle, Gladwin; Mr. and Mrs. A. N. Richardson, Ann Arbor; D. A. Richards, Port Huron; H. F. Rosenkrans, Durand; W. E. Reynolds, Dowagiac; C. A. Seekell, Detroit; Herbert Silvester, Detroit; M. W. Swift, Boyne City; Mr. and Mrs. F. B. Spencer, Cheboygan; A. D. Spencer, Detroit; Louis B. Schneider, Tecumseh; Mr. and Mrs. W. B. Thompson, Detroit; Mrs. Veasey, Coldwater.

ASSOCIATES.

Mr. and Mrs. Glenn H. Brown, Western Electric Company, Detroit; G. A. Brown, Nagel Electric Company, Toledo, O.; E. H. Cheney, Wagner Electric and Manufacturing Company, Chicago, Ill.; J. R. Cravath, *Electrical World*, Chicago, Ill.; J. J. Callahan, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago, Ill.; J. S. Corby, Monarch Incandescent Lamp Company, Chicago, Ill.; James B. Coale, Columbia Incandescent Lamp Company, St. Louis, Mo.; A. C. Carney, Nagel Electric Company, Toledo, O.; H. H. Cudmore, The Brilliant Electric Company, Cleveland, O.; C. S. Davidson, Holoplane Company, Newark, O.; E. M. Dixon, J. A. Roebling's Construction Company; W. D. Dygert, General Electric Company, Chicago, Ill.; W. K. Eicher, Fort Wayne Electric Works, Grand Rapids; L. H. Glass, F. Bissell Company, Flint; A. T. Holbrook, Excess Indicator Company, New York; A. B. Hoffman, Wagner Electric and Manufacturing Company, Detroit; George F. Johnson, General Electric Company, Chicago; H. R. Kent, Fairbanks, Morse Company, Detroit; R. J. Kirchner, General Electric Company, Detroit; M. F. King, American Circular Loom Company, Boston; R. L. Kimble, Central Electric Company, Chicago; J. M. Loudon, C. J. Litscher Electric Company, Grand Rapids; Mr. and Mrs. J. B. Lindsay, Westinghouse Electric and Manufacturing Company, Cleveland, O.; L. S. Lester, Fairbanks, Morse Company, Detroit; T. E. Lowe, General Electric Company, Detroit; F. C. Leonard, General Electric Company, Chicago, Ill.; Will Love, Shelby Electric Lamp Company, Traverse City; J. O. Little, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; F. M. McAdams, Westinghouse Electric and Manufacturing Company, Detroit; G. F. Mueller, Nernst Lamp Company, Pittsburg, Pa.; S. C. MacNeil, C. J. Litscher Electric Company, Grand Rapids; Clyde C. Miner, The Robbins & Meyers Company, Springfield, O.; E. V. Nicholson, The Franklin Electric Electric Manufacturing Company, Lapeer; W. S. Ortman, F. C. Teal Company, Detroit; A. C. Parsons, General Electric Company, Chicago, Ill.; F. L. Reynolds, Ft. Wayne Electric Works, Grand Rapids; H. A. Robertson, Illinois Electric Company, Chicago, Ill.; Wm. P. Swartz, A. T. Knowlson Company, Detroit; Ford S. Smith, Smith Chandelier Company, Detroit; Mr. and Mrs. W. J. Trott, Fostoria Incandescent Lamp Company, Grand Rapids; Chas. E. Taylor, Bryan Marsh Company, Chicago, Ill.; J. R. Townsend, Westinghouse Electric and Manufacturing Company, Detroit; Robt. J. Thorne, M. B. Austin Company, Chicago, Ill.; F. H. Van Gorden, Western Electric Company, Chicago, Ill.; R. M. Van Vleet, Cutler Hammer Manufacturing Company, Chicago, Ill.; Wm. C. Wing, The Brilliant Electric Company, Cleveland O.; C. S. Fuller, The Fairbanks, Morse Company, Detroit; C. H. Seaver, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago, Ill.

EXHIBITS.

The Westinghouse Electric and Manufacturing Company exhibited a line of small direct-current and alternating-current motors, fans and irons. The company in addition supplied illumination in front of the hotel, with a number of sixty-watt series tungsten lamps.

In the exhibit of the Central Electric Company, Chicago, were shown high-tension insulators, samples of Okonite and electric irons.

Exhibits were also given by the Fostoria Lamp Company, the Nernst Lamp Company, the Eureka Suction Cleaner Company and the Western Electric Company.

ENTERTAINMENT.

Entertainment features which were provided proved a welcome relaxation from the sessions of the convention. For the ladies present an automobile ride and a trip through the St. Clair tunnel were arranged. On Wednesday afternoon the entire body was taken on a pleasure trip down the St. Clair River. An inspection of the works of the Crystal Salt Company at St. Clair and a supper on Stag Island completed the excursion.

On Thursday morning, through the kindness of Mr. Lindsay and the officials of the St. Clair Tunnel Company, the members had the opportunity of inspecting the power house and equipment of this installation. The party was carried through the tunnel on the company's single-phase locomotives. The afternoon of the closing day was taken up by a ball game between the Port Huron Independents and the Detroit Edisons. A score of four to one in favor of the latter resulted.

Profitable German Chemical Factories.

From the annual reports of German chemical factories United States Consul-General Richard Guenther, of Frankfort, Germany, notes continued high dividends and trade activity. The works at Biebrich (capital stock about $2,000,000) earned $1,000,000 in 1909, paid thirty-two per cent dividends, and gave $100,000 as gratuities to directors. Several others earned large sums and paid twelve to twenty-seven per cent, with gratuities to directors. The Farbenfabrik-Bayer Company, of Elberfeld, whose capital is $8,500,000, made a profit of over $5,000,000, declared a twenty-four per cent dividend, and an extra dividend of twenty-one per cent from overgrown reserve funds, which still contain $4,355,000 after the disbursement. This concern states that it has perfected an artificial rubber. The Badische Anilin und Sodafabrik Werke (capital $8,500,000) paid twenty-four per cent. It does an excellent business with the United States. Owing to the new British patent law it has erected works in England, and has also built extensive works in Norway for electrically extracting nitrogen from the air.

Imports of Manufacturers' Materials Increase.

The Bureau of Statistics of the Department of Commerce and Labor has compiled statistics to show how the value of the imports of manufacturers' raw materials has been affected by the Payne tariff law which went into effect August 5, 1909. By comparison with similar periods of the last few years it was found that the imports during the eleven months ended June 30, 1910, increased in nearly every line of raw materials for manufacturers' use. Among materials used in electrical manufactures the imports of copper ore and matte were 890,000,000 pounds, copper pigs and bars 227,000,000 pounds and indiarubber 96,000,000 pounds, each of these figures exceeding those of any similar eleven-month period.

General Electric Business Good.

The General Electric Company, which is doing the largest business in its history, enjoyed a decided increase in gross sales during July as compared with May and June. July orders came in at the rate of close to $75,000,000 per annum, comparing with a rate of about $71,000,000 in June and $69,000,000 in May. The largest total of orders received by the company in any year was in the fiscal twelve months ended January 31, 1907, when orders for $60,483,659 of apparatus came to hand.

Traffic During Knights Templar Conclave, Chicago.

During the recent conclave of the Knights Templar in Chicago, the Chicago Railways Company, operating on the north and west sides of the city, earned an average of $40,000 per day during the six days, an increase of sixteen per cent as compared with the same period last year. The company carried daily on its cars 800,000 fare passengers and 600,000 transfer passengers, a total of nearly 1,500,000 passengers daily.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

BONDING LEAD-COVERED CABLES TO PREVENT ELECTROLYSIS.

BY W. G. MIDDLETON.

Opinions as to bonding methods for the prevention of electrolysis of lead-covered cables are so varied and the conditions in various cities are so different that it is important to review the situation. There is a tendency among many to assume the conditions and to locate bonds in the wrong place. One may be able to realize the exact action of currents of relatively small size through ordinary resistance, but the flow of thousands of amperes through the very low resistance offered by some portions of the earth is difficult to comprehend clearly. Various soils and different degrees of moisture produce such a range of conductivity that enormous mistakes are common.

One method of reducing this tendency to error is to get a graphical conception of the whole from something that we can actually see. This must also be something that is more or less common, and it should apply as closely as possible. The water analogy has always been open to criticism on account of the inertia of the water and its different rates of flow, but it will probably not be a waste of time to make the comparisons and carry out the points in detail. It should result in a clearer conception of the actual conditions as shown by potential readings.

Potential Readings.—For clearness, we will take a city having a centrally located street-railway power house with radiating railway lines. This city also has a telephone system. The latter is a means of obtaining the potential of the earth in all parts of the city, near the power house and at a distance, with reference to one common point. Of course, these potentials will change during the rush hours, but if the readings are taken during the normal parts of the day, and not while the cars are heavily loaded, consistent results will be obtained.

A man sitting at a telephone switchboard may take readings from six or more men in various parts of the city. Each man carries a coil of wire and a small steel ground rod. He calls the central exchange from a telephone located near the point desired and is given the man with the voltmeter at one of the boards. This man makes direct connection with the calling telephone and the voltmeter which is before him. The voltmeter is connected to the exchange ground and is a special instrument having a high resistance to reduce the error due to the resistance of the telephone line. The instrument should have a range of about (0-15) and (0-150) volts and have a sensibility of about 2,500 ohms per volt.

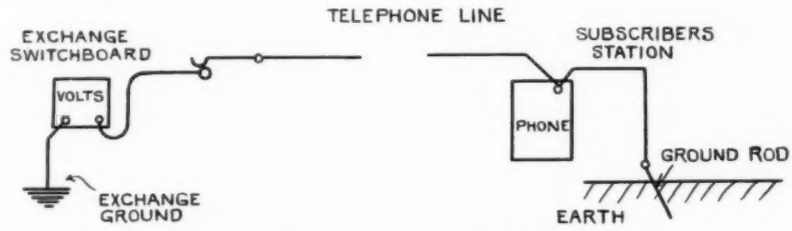


FIG. 1.—METHOD OF TAKING POTENTIAL READINGS.

The calling party with the ground rod now hangs up his receiver and attaches the wire of the ground rod, which he has inserted in the earth at a moist place, to one of the telephone binding posts. (See Fig. 1.) The voltmeter operator now takes the difference of potential between the earth at the distant point and at the telephone exchange, recording whether positive or negative and the amount of the reading on a map. Four readings may be taken in every square block. On completion, lines are drawn through the points of equal potential for, say, every half or quarter volt. These lines will be found to be irregular circles concentric about the power house. The earth potential at the power house may be found to be from six to fifteen volts lower than points two or more miles distant and near the outer edges of the city.

Sometimes there will be several centers about which the concentric lines will group themselves. These may be caused by substations or heavy copper return cables. Also the effect of a well-bonded car line may possibly be noticed.

Bonding Cables Together.—To make conditions as simple as possible and to stop electrolysis between cables, all cables should be bonded sheath to sheath in all manholes. This is easily accomplished where cables are racked close together by using strips of flat copper, tinned by drawing them through a pot of molten solder. A strand of three tinned copper wires may be used as well. A large soldering copper is suggested for soldering the bonds to the cable sheaths, as wiping them on is not necessary and is more liable to injure the sheath.

Bonding at every other manhole will not prevent the cables from being at different potentials in the unbonded manhole, as will be the case when two different-sized lengths parallel a same size straight through. A lateral will often change the potential of a cable with reference to other cables; so all manholes must be bonded. This prevents a high cable from being injured by electrolysis on account of a continual flow of current to a lower-potential cable which may be very close but not touching (metallically).

Local Readings.—It will not be necessary to make a potential map unless

conditions are very complex. Local readings must be taken at every manhole between the cable sheaths and the earth immediately surrounding the ducts as closely as possible. A reading with the earth at the bottom of the manhole is safe, but readings to a water hydrant or gas main may be very misleading. Readings to the car track will often be very fluctuating and are of little value, as their influence may not extend more than a few feet from the rail in dry weather. A difference of potential will be found between earth at the bottom and at the top of the manholes, and wet weather will change the readings considerably.

The first step is to ascertain the potential of the cables with reference to their surrounding earth. If they are electrically positive to the earth even to the extent of only one-tenth of a volt, steps should be taken to lower the potential of the cable. The lead sheath will dissolve and go with the current if the current passes through an electrolyte such as moist earth. Lead is much more susceptible to electrolysis than many other metals, and especial care must be taken with lead sheaths. If this current can be conducted off through a metallic contact, no damage to the sheath will occur.

There is no danger in a good-sized sheath current if it leaves the sheath through a metallic contact. This is not so with water and gas pipes which have joints of higher resistance than the remainder of the pipe; this causes the current to shunt around the joint and produces electrolysis at the points where it leaves the pipe. This makes it difficult to prevent electrolysis in iron pipes with lead-calked joints, although iron has the advantage of not being nearly so susceptible to electrolysis as lead when the damage to the sides of the pipes is considered.

If the lead sheath is electrically negative to the surrounding earth, no damage to the sheath will occur. It may be that the cable is fluctuating—that is, positive during heavy street-railway loads and negative at other times; this requires that readings be taken during light and heavy loads to get the range of the fluctuations. The cable in another section may be just opposite—negative during heavy loads and positive during light loads. It is important that the connections to the voltmeter used in taking local readings be marked so that it may be known absolutely whether readings are positive or negative. For this reason a switch or commutator on the voltmeter, if such can be used, must be checked and plainly marked, and the leads be made so they cannot be interchanged.

An instrument with zero in the center of the scale is preferable, as many times, in cases of poorly bonded rails and intermittent service, the needle will fluctuate first on one and then on the other side of the zero. It is important to have an extra binding post on the voltmeter, so that the moving system may be used alone as a millivoltmeter and the direction and amount of current in a heavy bond be ascertained without having to cut the bond.

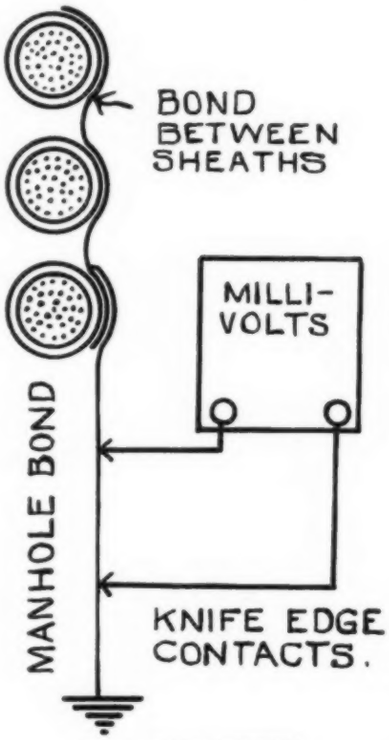


FIG. 2.—BOND TESTING.

It may be found that in some localities the cable is positive to the earth. These are danger zones and must be changed. The potential of the cable must be lowered until it is below, instead of above, that of the adjacent earth. Sometimes it is difficult to do this even under favorable conditions—that is, even where it is possible to bond directly to the negative busbar at the power house. For this reason it should first be determined if the removal of existing bonds will not better the conditions. All bonds can be tested with a millivoltmeter of a low range before taking the local manhole readings if it is suspected that they are conducting current to the sheath instead of from it. This is accomplished by taking the drop over a few feet of the bond wire, as shown in Fig. 2. By taking into account the size of the bond wire, the amperes in the bond can be determined and recorded as well as the direction of the current. While no damage will occur by bringing current to the sheath at the point of contact, this current must leave the cable at some point, probably nearer the power house, and unless taken off on a metallic bond will cause electrolysis. Even when well bonded to the power house, it is easily possible to so flood the power-house bond that the potential of the cable will be above the earth and leaks at the joints of the conduit and other points will occur.

Avoiding Excess Current.—It will be much easier to cope with the situation if the cable has a small instead of a large current in it. Then the fall of potential along the sheath will not be greater than that of the earth, and the cable can always be kept below the potential of the earth, which is also falling more or less rapidly as the power house is approached.

If the cable sheaths are in contact with the iron framework of a distant building whose potential is six or eight volts above the earth surrounding the power house and the cable runs in a general direction toward the power house, it becomes a race between cable and earth. If the combined cable sheaths are of large cross section, they may be able to carry the current with a drop equal to or less than that of the earth, but if the cable sheath is small, the earth may be the better path and be of a lower potential near the power house than the cable, causing electrolysis of the lead sheath.

Therefore the current in the cable sheath should be reduced as much as possible, so that the fall of potential per foot will be small and the cable safe or electrically negative at all points. For this reason, when possible, all metal conduits that might bring current to the sheath should be insulated from the sheath. Often this is impossible, as in cases of iron-pipe laterals and iron-pipe runs.

Subsequent Readings.—After removing a bond or other source of excess

current, manhole readings in the danger zones must be taken again and the change noted. If the utmost has been done to reduce the current on the sheath without success, then a better bond to the power house must be installed. This bond should be close or attached to the negative busbar at the power station, to avoid all possible drop in the return feeder system. Generally by attaching the bond close to the switchboard, instead of to a return feeder in the manhole outside, a gain of several volts can be secured. This bond must also be sufficiently large. Under increasing railway-load conditions the bond, though sufficient when installed, may become warm, increasing the drop, till it is necessary to increase its diameter several times. Also the sheath of a cable may have to be assisted with No. 00 or No. 0000 bare copper wire drawn in the duct with the cable for blocks where a small cable sheath connects two localities having a considerable difference of potential.

The effect of a well-bonded track or of heavy rails welded together must be guarded against. A cable may be negative to the earth at two adjacent manholes and positive where a track crosses it at right angles between these manholes. Therefore a cable is not safe unless it is from one-half to one volt below the earth in districts where there may be radical variations in the earth's potential.

The conditions are often so complex that the instruments must be followed blindly, experimenting until the condition is relieved. All ordinary situations will be much clearer if a definite habit is formed of thinking of the conditions in terms of the water analogy.

Water Analogy. — Imagine a large swamp. The power house is on comparatively dry ground, due to water being pumped away from this point and not because the ground is of a higher level. If the pumps should stop, the dry ground would be submerged, the ditches which feed the pumps overflowing. The dynamo or rotary pump is sucking the water from the ditches and sending it out overhead and letting it come back through the ditches from different points where the cars may happen to be. The track or ditch may be a narrow or wide one, corresponding to the thoroughness of the rail bonding. The earth may be a good or poor conductor—that is, the swamp smooth ground or overgrown with grass. Now all this water tends to go to the low sinkhole from which the power-house pumps are taking their supply, and it follows the paths in inverse proportion to their resistance.

It is in a network like this that the lead-covered cables form porous jointed drains. The water that is in these drain pipes, which correspond to cable runs, is not to be allowed to leak into the swamp at any point or into any of the other ditches, but must flow only into the rotary pump basin. Therefore this drain pipe must always be submerged, or it will leak at its joints. Sometimes ditches of good capacity and therefore low level with respect to surrounding water extend from the basin, corresponding to heavy copper negative feeders. It is as safe to empty the cable drain pipes into these negative feeder ditches as into the basin unless the cable goes on closer to the basin. In this case emptying the cable pipe into the basin might reduce the level where it passes the negative feeder until water will flow from the negative feeder to the cable pipe and the cable will be filled to overflowing at points nearer the basin. Therefore connect to the basin first and see if the negative feeder will help or impair the conditions.

The negative feeder, for a part of the day at least, may be higher in level than the cable drain. If connection to it be made with its almost unlimited capacity, the cable pipe would leak near the basin and cause electrolysis. This would force the enlarging of the cable pipe near the basin to take care of the period of heavy load when the negative feeders are at a high level.

It is better to keep the cable pipes disconnected from any waterway of large capacity that may rise in level and flood everything. Also precautions must be taken to prevent the cables receiving smaller inflows and leakage or drainage from the surrounding earth. Many small branches draining the surrounding earth, as iron-pipe laterals, corresponding to an open ditch, pouring freely into the cable pipe, will cause a flood that it will be expensive to conduct safely into the power-house basin. These little incoming tributaries may be dammed up by using a non-conducting lateral.

Generally the return feeder runways are to be relied upon. In fact, they form a system of sinkholes or basins where they appear and join to the track and are open to drainage from the adjacent territory. In this case, their level having been taken during a period of twenty-four hours, they may be connected to, the same as the main basin. In this way the cable pipe may be relieved from a large volume of its flow, and the bond to the main basin need not be of such a large capacity.

Not only may the intermediate return-feeder low points be a danger to the cable pipes during a part of the day, but there may be substation pumps that produce areas of low level. Substation basins are much more liable to change suddenly than return-feeder areas, due to the starting and stopping of the pumps. The pumps are of such capacity that when they are running it is only safe to drain into their basin, but when they stop the cable pipes are connected to a far-reaching supply system and are in great danger of being badly flooded. In this case a water valve or means of disconnection must be had that disconnects when the substation pumps are not running and connects when the pumps are started. A switch on the substation switchboard that opens the heavy bond to the substation negative busbar is ideal if arranged so that it cannot be neglected. The rapid decay of the cables depends, in danger zones, on the height of the cable pipes above the surrounding water level, upon the tightness of the joints of the pipes, and upon the leakage through the pores of the pipe. Also at every manhole this pipe enlarges and is moist, therefore very porous; there is a large area over which leaks may occur, and often the cable comes in contact with water in the bottom of the manhole, which is analogous to holes in the pipe allowing serious leaks at a concentrated point—a very dangerous condition. When the cable pipe crosses a well-bonded track trench, the pipe may pass above the level of the water in this deep trench, forming a viaduct in true fashion, leaking at every joint and pore.

It is a matter that needs very careful investigation with a surveyor's level or voltmeter before an ill-considered bond is attached and the pipe so filled that it is impossible, using ordinary means, to drain it or make it receive leakage

at all points except at the basin or return-feeder connection.

Now, holding to the point of view shown by the water analogy, it will be seen that draining the special channels by connection to a track channel is questionable. It may produce an ideal condition, but whether this condition will last or not is questionable, depending upon the track bonding and the effect of heavy traffic. A welded rail would be quite sure to remain constant, but a connection to a poorly bonded track might result in the speedy decay of the cable unless watched more closely than is generally necessary. In case a bond should break, the section of track to which the cable was bonded might be raised 100 volts while a car is on or beyond that section, and this would destroy a cable in a few weeks. Therefore the only safe conductors to bond to are earth connections, such as well pipes and ground rods, negative busbars and return-feeder cables, welded tracks. Ground rods will be found very inefficient when required to carry away much current. Sometimes a ground plate may be sunk in a river and prove very effective.

Abnormal Conditions.—When there are great fluctuations during different parts of the day at a return-feeder connection and the level of the water in the cable pipe cannot be dropped low enough to be at all times below the surrounding swamp level, it may be necessary to put in an instrument that will close a valve in the bond when the level of the feeder basin is below that in the cable pipe, and open the valve when the level of the basin is above the cable. In extreme cases, where the natural country takes a fall in level, as a city largely on sand but with occasional dark wet earth patches or surrounded by a river, it may be necessary to install pumps or dynamos to drain the pipes in these localities.

Bad Practice.—It will be readily seen that as a general rule it is a mistake to bond cable sheaths to the railway rail, as a poor bond from one rail to another anywhere on the road to the power house will be as a dam in the ditch and raise the level and suddenly flood the cable where it was relieving it before. Even with welded rails, if the traffic is heavy, the fall of potential along the rail may be greater than along the earth. This may be tested by taking readings from rail to earth in the bottom of the manhole or at some distance from the rail. In cases, however, where the cables do not go in the vicinity of the power house, the rail is the only connection for a bond that is available. If a good low-resistance connection to the earth could be obtained it would be ideal, but even many 1½-inch iron ground pipes driven into the ground in the bottom of the manhole will not carry the fifty, one hundred or more amperes that are required to drop the potential to a safe point.

Accidents.—Readings should be taken of the cable potential below the earth every few months, at least in the areas where the margin of safety is small. Occasionally the various electric conductors of a city produce change in the earth potential, due to accidental grounding. A leak in the outside of a three-wire direct-current system that is 110 volts below the earth potential will produce a low-potential area that may destroy a new 100-pair telephone cable in six months or less. Several places can be selected and used as pilot points that may be measured frequently.

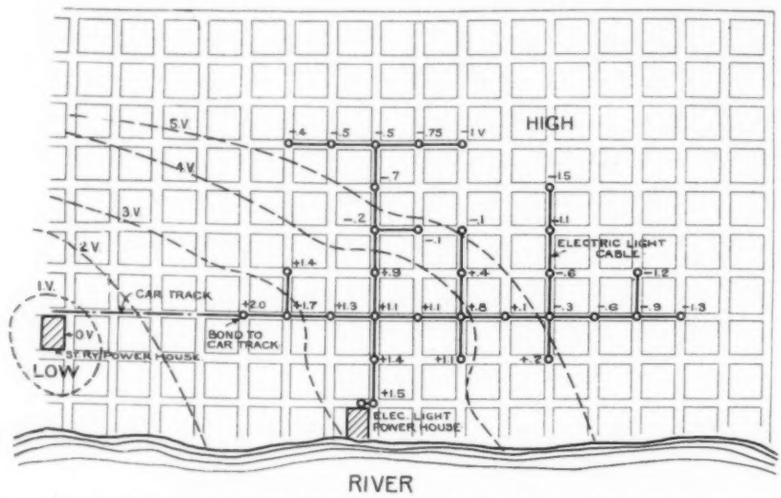


FIG. 3.—EQUIPOTENTIAL LINES SURROUNDING LOW AREA, AND LOCAL MANHOLE READINGS BEFORE ATTACHING BOND.

FIG. 4.—EQUIPOTENTIAL LINES SURROUNDING HIGH AREA, AND LOCAL MANHOLE READINGS WITH INADEQUATE AERIAL BOND.

Examples.—In Fig. 3 is shown a city in which, although the power house is

not central, the conditions required but one bond. This bond, however, will have to be measured often, for a broken rail bond between it and the power station would be disastrous. Before bonding, half of the manholes showed that the cable was from one-half to two volts above the earth, while at the bond to the track there was a difference of from three to four volts, and with a 300,000-circular-mill bond sixty-five amperes was shown.

In Fig. 4 the conditions are very difficult. The fall of potential over the power house bond is so great that the cables are not greatly benefited. The track, for this reason, is about as safe a return at the nearest point to the power house as the bond. However, there is very fluctuating current in the rails, due to the irregular street-car schedule, and it would not be safe to bond to the rail. Also the cable crosses the river in one place and is close to it in another, and in both places the cable is electrically positive and ground rods are of no value. Where the cable crosses the river a copper sheet of large area may be sunk in the river and bonded to the cable with a No. 00 or No. 0000 copper conductor. As the distance from the river is too far for this kind of bond in the other case, a connection will have to be made to an earth plate of proper dimensions placed in the earth, or to the iron pipe of a driven well.

Conditions are never found twice alike; therefore each situation will allow free play of the imagination and call for ingenuity in relieving the situation in the most direct manner.

Generates Current by Old Water Wheel.

Michael Weber, a miller who for years has operated a waterwheel-driven mill on the Charlton River near Kirksville, Mo., has utilized his wheel to drive a seven-horsepower dynamo which generates sufficient power to light his and his neighbors' houses by electricity. The miller's successful experiment has revived the suggestion made several years ago by Engineer Brimson, of the Iowa & St. Louis Railroad, that sufficient power could be generated by damming the river to generate electricity to light the towns of Kirksville and Novinger. There is a possibility that this plan will be taken up in the near future.

Tariffs and Water Powers in Japan.

Consul-General Thomas Sammons, of Yokohama, in his annual report for 1909, comments on Japan's revised tariff and the possibilities of hydroelectric power in the development of Japanese industries.

In considering the enforcement of Japan's new tariff, he says, attention may well be directed to the fact that Japan has an abundance of cheap labor; its people are clever artisans; its natural resources are great. Today the people of Japan are, as a rule, making what they have to sell in their houses or small shops, and they undoubtedly possess possibilities of immense fortunes by virtue of the mere deftness of their fingers. With these conditions and an estimated 1,000,000 horsepower available for hydroelectric harness, Japan, on a protective traiff basis, may be expected to make a remarkable record by assembling its cheap and clever hand labor into mills and factories provided with the most modern power machinery and thus converting a large share of its exports from raw to manufactured goods.

There has been a rush for water-power rights throughout Japan, and it is now evident that the government proposes to restrict those who are presumed to seek franchises of this nature for purely speculative purposes. American capital is largely interested in hydroelectric enterprises in Japan, and under favorable conditions American capital is ready for large investment in extensive power plants. Japan is well adapted for this purpose and such enterprises would convert the Tokyo-Yokohama and the Osaka-Kobe sections into two of the world's greatest manufacturing centers.

Electric Company to Be Sold Out.

The Chester County Electric Company having failed to pay to the Central Trust and Savings Company, of Philadelphia, $204,606 in a specified time, as required under a decree handed down by Chancellor Curtis, all the property of the electric company will be sold at public sale on September 1.

Tax on Electric Poles.

The town council of Coatesville, Pa., has placed an annual tax of thirty cents on each electric light, telephone, telegraph or similar pole in the borough.

Power Plant for Cooperstown Hotel.

The Hotel Fenimore, Cooperstown, N. Y., will shortly be equipped with a large new power plant, work on which has already commenced.

The plant is a part of the extensive plans completely to remodel the hotel which have been going on for over a year. The plant will be erected on a lot behind the hotel. It will be 100 by 50 feet outside dimensions, two stories and attic high and is to be constructed with stone foundations and brick walls.

The ground floor will contain the boiler and engine room and laundry while the second floor will be finished into rooms for the hotel employees. The equipment is to be furnished by the Otis Engineering Company, of Oswego.

Larger Quarters for St. Louis Company.

The Union Electric Light and Power Company, St. Louis, Mo., has arranged to take possession of the Shubert Theater Building in order that it may have room for its business. All of the building except the theater portion will be occupied by offices of the company.

Alterations are being made in order that the building will be best suited to the needs of the new occupants. The company will take possession about December 1.

Municipal Plant for Thibodaux, La.

A new municipal electric-light plant will shortly be built in Thibodaux, La. The first municipal plant in this town was made possible by a specially levied tax, but the new station will be built entirely from a fund derived from the liquor taxes. Since the storm of last December, which put the arc lamps in the town out of business, the streets have been lighted satisfactorily by incandescent lamps.

Private Plant To Operate Drawbridge.

A dispatch from Newburyport, Mass., states that the county commissioners are to install a generating plant at the Newburyport bridge so that power for operating the draw may be generated and the county be independent of the railway company and the electric light company. It is believed the power can be supplied at a much less cost to the county.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE ILLUMINATION OF STUDY ROOMS.

ELECTRIC LIGHTING AT THE UNITED STATES NAVAL ACADEMY.

In the July number of the *United States Naval Medical Bulletin* is given a very extensive report of the illumination of the study rooms in Bancroft Hall, which is one of the dormitories for the midshipmen attending the United States Naval Academy at Annapolis, Md. This report, which was made by Engineer A. L. Parsons and Dr. H. W. Smith, is an exhaustive study of the former equipment and of the requirements for an adequate illumination of such study rooms, and finally a series of recommendations for the improvement of this illumination.

There are two types of study rooms, one having dimensions sixteen feet by sixteen feet with a study table three feet nine inches square in the center of the room and two bookcases against the wall on opposite sides of the table. In some of these rooms there are also beds, wardrobes and washstands, since these rooms are the living-rooms for the students throughout their four-years course. The small rooms are eight feet by twelve feet in floor area, and have a table three feet nine inches by two feet six inches placed against one of the walls. These smaller rooms are equipped with a bed, wardrobe and washstand. In the large rooms two windows afford daylight illumination; in the smaller rooms there is only one window. All the rooms are unusually high, those on the ground floor and first story having a height of eleven feet six inches, the second and third stories eleven feet one inch, and the fourth story ten feet five inches. The walls were painted with a light reddish brown color, the ceilings were of a dead white color. All the windows were fitted with wooden slat shades.

In the larger rooms there were two adjustable drop lights fitted with metal shades over forty-watt tantalum lamps. The small rooms were equipped with one desk-light with semi-opaque green glass shades over a forty-watt tantalum lamp. The illumination resulting was very bright over the area of the table, leaving the rest of the room in comparative darkness, so much so that the titles of books in the cases against the wall could scarcely be read. At the center of the table the illumination was 7.2 foot-candles; at the edge of the table it was 2.9 foot-candles; four feet from the center it was only 0.1 foot-candle, and at the bookcase, seven feet from the center of the table, it was only 0.03. Although the illumination in the smaller rooms was somewhat better than in the larger ones, it was far from satisfactory in all of them. No drawing or other work of fine character is done in any of these rooms, but the illumination is required almost exclusively for reading ordinary print and for writing.

The report includes an exhaustive study of the physiology of the eye and the character of lighting that is most suitable to avoid fatigue and unnecessary strain on the optic nerves. The human eye has its full sensitiveness when the illumination affecting it is between one and two foot-candles. Any increased intensity in illumination is of no advantage and may be productive of harm. The requisite illumination for various classes of work is given in the following table:

Character of Work.	Foot-candles.
Details in dark objects	5. to 10.
Drafting on dark paper	3. to 5.
Desk lighting	2. to 3.
Newspaper reading	2. to 2.5
Reading clear print	1.5
Writing	1.5

From this table the conclusion was drawn that a provision of 2.5 foot-candles on the plane of the study table would be sufficient and would provide a safe margin for loss by deterioration of the lamps.

The authors think that the restriction of the circle of illumination to the area of the table is a mistake and that comfortable work should be possible anywhere within an eight-foot circle. This dimension is specified because it permits the students to sit opposite the table and read a book held in the hands. This position is a more hygienic one than the placing of the book on the table, because this invariably requires the reader to bend over the book, which is a bad position. Although the circle of adequate illumination should be of reasonable size, it should not embrace the entire room, for it has been found that it is conducive to comfort to have the working area somewhat more illuminated, and that less actual foot-candles are then required. In fact, the falling off in intensity of illumination near and on the walls should be marked, though gradual.

Glare is caused by an excess of light, direct or reflected, a bright point in a dark field, or by rapid alterations in light intensity. It should be carefully guarded against because it is injurious to the eye. To this end the light should not be much in excess of the actual requirements. It should be steady and its source should be fixed, and so located as to avoid direct reflection. It should be either removed from the field of vision or suitably shaded.

Respecting the color of the light furnished, that of the Nernst and tungsten lamps was regarded as most suitable because it is very nearly white in each case. Due consideration should be given to the decoration of the rooms. Very light walls add greatly to the effectiveness of most lighting systems. The color selected should, therefore, be light in order to get the maximum value from the energy expended, and to avoid undue contrast between the work and the surroundings. The effectiveness of various surfaces with regard to the percentage of light reflected by them is given in the following table:

Character of Surface.	Per cent.
White paper	80
Chrome yellow paint	60
Yellow pine	45
Yellow paper	40
Light yellow paint	40
Emerald green paper	18—.08
Blue green paper	12—.1

The ceiling should be painted white, slightly tinted with yellow. For the

walls a light greenish yellow should be used, which by tungsten illumination becomes a pleasing yellowish green. For shady rooms a tinting tending toward yellow should be used, whereas in those having sunny exposures the tinting should tend toward green. A dado of dark color of a height of some four feet should be applied. The old style wood window shades should be replaced by rolling cloth shades of a color harmonizing with that of the walls. Pictures should be placed on the walls to make the rooms cheerful.

With respect to the systems of illumination, the indirect system was not regarded as well adapted to these study rooms. To obtain a reasonable degree of comfort in the lighting it is estimated that the amount of light on the work must be about sixty per cent greater with the indirect than with the other methods. The strong stimulation of the periphery of the retina of the eye by side light from the walls contracts the iris, thus excluding much of the light from the work and by comparison the work appears dark, since its image falls on the less sensitive part of the retina. Unless special reflectors are employed there is a great waste of light. It is estimated by the authors that as much as two to five times the energy will be required to get equally satisfactory illumination if the indirect system were used. Moreover, dust and dirt have a marked effect in lowering the efficiency, probably more than with other systems. A perfect evenness of illumination is in their opinion, not altogether advantageous.

Any direct system in which unprotected lamps hang low in the rooms is considered to be barbarous. The apartment is illuminated most unevenly, disturbing shadows and reflections are everywhere present, and in no way can the area of work be made to appear other than dark so long as points of light are present in the line of vision. Translucent shades of opal, milk, sandblasted, or other varieties of glass are useful in diffusing sources of high intrinsic brilliancy. On the other hand, they do not satisfactorily obscure filaments without disproportionate loss of light by absorption. They do not redirect the rays and distribute them where the greatest illumination is desired. Opaque reflectors and semiopaque shades usually give very uneven illumination and cause extreme contrasts of light and shade.

A direct lighting system provided with suitable shades, such as the Holophane prismatic glassware, is regarded as most suitable for this purpose by the authors. Various types of this kind of reflectors and of stalactites were considered. With a bell type of reflector only the sides of the lamp are enclosed and a bulb with frosted tip is required. This frosting is usually insufficient to diffuse the light properly, and it exhibits areas of very high intrinsic brilliancy. Prismatic globes were not regarded as suitable as the stalactite form because they give too wide a distribution and are better adapted to rooms where a broad general illumination is desired; therefore the stalactite form is recommended. The loss of light with various forms of glassware is given in the following table, the percentage representing the absorption of the light:

Kind of Glass.	Percent.
Clear	10
Holophane prismatic	12.3
Light alabaster	15
Light sand-blast	20 to 25
Opalescent	20 to 40
Ground	25 to 30
Opal	25 to 60
Milky	30 to 60

As to the kind of lamps, of all the electric types the tungsten was regarded as the most suitable, partly on account of the high efficiency, the minimum effect of changes in voltage, the long useful life, and the satisfactory color of the light. The use of gas was not seriously considered, because it vitiates the air, a mantle of sixty-four candlepower using as much oxygen as twelve men; its heat production is also undesirable; it adds to the dangers of fire; it forms explosive mixtures with air, and it is a possible agent in accidental asphyxiation.

A considerable number of experiments to determine the illumination on the working plane were made with various forms of fixture, and a study of the distribution secured resulted in the following conclusions among others: The former illumination was excessive over the working area and produced undue brightness on the walls; with all types of bell reflectors, even with frosted bulbs and satin-finish shades, the intensity of the source of light is brighter than is desirable; prismatic stalactites will produce an adequate general illumination and satisfactory distribution over the working area, reduce to a greater degree than any other type the intensity of the source, and will lend a sparkle and color to the light which is most pleasing.

It was recommended, therefore, that the large rooms be equipped with two forty-watt tungsten lamps in place of the forty-watt tantalum lamps formerly used; the small rooms should be equipped with one forty-watt tungsten lamp. All these lamps should be provided with prismatic stalactites mounted six feet above the table in the large rooms, and five feet above the table in the small rooms. Keyless sockets should be used on all fixtures, with drop switch in the large rooms and wall switch in the the small ones. The rooms should all be redecorated in accordance with the findings of the authors. The study tables should be finished to have a light green matt surface.

Lighting of Rochester Residence Streets.

The Rochester (N. Y.) Railway and Light Company is facing a serious difficulty in furnishing sufficient light in some of the streets in the residential sections of the city due to the fact that many of these streets are almost roofed over with dense foliage, making it impossible for the lights to shed any great degree of brilliance for more than a few feet.

All the contracts call for the lamps being elevated at least eighteen feet, and this necessitates their being almost inclosed by the foliage in some cases. As they are placed 250 feet apart, there are inevitably spaces that are left in darkness, and this the company is trying to avoid by trimming the trees, but is meeting with great opposition from the property owners.

As a means of relieving the situation City Engineer Fisher has requested the company to submit an estimate for the lighting with tungsten lamps of Wolcott Road, which runs along the east side of the river from Clarissa Street to Elmwood Avenue at the entrance to Genesee Valley Park.

The company has prepared an estimate and it is probable that the lights will be installed at once. Forty-watt Mazda lamps are to be used and about forty lamps will be needed.

A new system of police telephones is being installed at Fargo, N. D. The call boxes are being placed on the poles of the Northwestern Telephone Company. At each box will be placed a red signal light to permit the sergeant at police headquarters to call any desired officer on patrol duty.

TELEPHONY—TELEGRAPHY, *and* WIRELESS.

Valuation of Seattle Telephone Properties.

The Department of Public Utilities of Seattle has employed Frank B. Hall, of Wheeling, W. Va., and C. H. Judson to investigate the values of the two telephone plants of that city, *i. e.*, Pacific Telephone and Telegraph Company and the Independent Telephone Company of Seattle, and to make inquiry into the rates charged by the companies for the purpose of ascertaining whether the companies are at present charging fair and equitable rates, and whether it is possible for them to continue to pay dividends on the present rate, or whether it is possible for them to reduce the rates and conduct a profitable business.

The result of this investigation will be brought to the attention of the Washington Railroad Commission, which body will hold a hearing on the case at Seattle on September 26.

American Telephone Purchase Restrained.

The Kinloch Long Distance Telephone Company has secured an injunction at Springfield restraining the American Telephone and its subsidiaries from purchasing control of the Interstate Telephone and Telegraph and other independent companies whereby the Kinloch and other independents would be kept out of Chicago and limited in other portions of the state of Illinois.

Cuba's Telephones.

One of the Cuban Telephone Company's officials in speaking of the telephone service in his country said that the growth of the industry there has been remarkable and that it is steadily taking a firmer hold.

This official said in part: "The telephone service is quite an institution in Cuba at the present time. Cubans have taken to the new mode of intercommunication and a great deal of business, which formerly required personal journeys or lengthy letters, is now transacted by telephone. Conditions have so improved in Cuba that Cuban girls can now be employed on the switchboards just as in this country. This is a matter which would have been almost impossible without entire corruption some years ago."

Hongkong Wants Wireless.

In stating that great interest has lately been taken in Hongkong in the question of wireless telegraphy, Vice-Consul-General Stuart J. Fuller says those interested in merchant shipping desire that a commercial wireless station be established in Hongkong, and the chamber of commerce and many influential residents in the colony have strongly urged it.

A proposal was made last fall by an American company to establish a wireless station to do a commercial business. It was prepared to put in a first-class installation, capable of communicating with Manila, Singapore, Shanghai, and Yokohama, and though it did not believe that the station would be profitable for some time, it was prepared to bear the early losses in consideration of a license giving it the sole right to conduct a commercial wireless telegraph business for twenty-five years, with the proviso that the government should have the right to purchase the station and business at a valuation at the end of five-year periods. The proposition was referred to the colonial office in London, but was not accepted. At present there are no facilities in the colony for handling commercial messages by wireless, although the American, German, and Japanese mail steamers calling at the port are being equipped with the apparatus.

Chicago Subway Contracts.

The Chicago Subway management says that telephone contracts secured and assured by January 1 will bring in $3,000,000 annually.

Wireless On Dirigible Balloon.

During September an attempt will be made by the Walter Wellman expedition to cross the Atlantic Ocean in a dirigible balloon. The airship will carry six men and will be equipped with a wireless telegraph outfit by the Marconi Wireless Telegraph Company. The well-known wireless operator, J. R. Irwin, will manage the sending of messages that will keep the airship in touch with Atlantic steamers. Thus, although the wireless equipment on the aircraft will be of only limited range, by relaying the messages through the steamers the experiences of the dirigible throughout its long flight will be made known to the world.

The Largest Telephone Exchange.

In Hamburg, Germany, there has recently been opened a new common-battery telephone exchange, which is at present wired for 35,000 individual lines. It is arranged so that it can be enlarged to an ultimate capacity of 80,000 lines, thus making it what is believed to be the largest telephone exchange in the world. The new exchange combines seven other exchanges.

Train Dispatching By Telephone.

Following recent tests, installation has been begun by the Lehigh Valley of telephone instruments over its line between New York and Easton, Pa., and between Penn Haven Junction and Wilkes-Barre. According to officers of the road, the telephone dispatching system has proved less subject to delay and interruptions than when the telegraph was used.

Wireless In Argentina.

It is stated that the Postmaster General of Argentine Republic has submitted to his government a scheme for replacing the telegrah system of the country by wireless telegraphy, as he considers the atmospheric conditions very favorable for wireless operation.

The History of the Telephone.

Litigation Over the Telephone—II.

BY HERBERT N. CASSON.

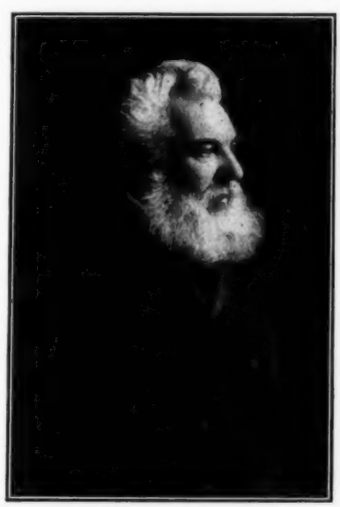
After the victory over Dolbear, the Bell stock went soaring skywards, and the higher it went, the greater were the number of infringers and blowers of stock bubbles. To bait the Bell Company became almost a national sport. Any sort of a claimant, with any sort of a wild tale of prior invention, could find a speculator to support him. On they came, a motley array, "some in rags, and some on nags, and some in velvet gowns."

One of them claimed to have done wonders with an iron hoop and a file in 1867. A second had a marvelous table with glass legs. A third swore that he had made a telephone in 1860, but did not know what it was until he saw Bell's patent. And a fourth told a vivid story of having heard a bull-frog croak via a telegraph wire which was strung into a certain cellar in Racine in 1851.

This comic-opera phase came to a head in the famous Drawbaugh case, which lasted for nearly four years, and filled ten thousand pages with its evidence. Having failed on Reis, the German, the opponents of Bell now brought forward an American inventor named Daniel Drawbaugh, and opened up a noisy newspaper campaign. To secure public sympathy for Drawbaugh, it was said that he had invented a complete telephone and switchboard before 1876, but was in such "utter and abject poverty" that he could not get himself a patent. Five hundred witnesses were examined; and such a general turmoil was aroused that the Bell lawyers were compelled to take the attack seriously, and to fight back with every pound of ammunition they possessed.

The fact about Drawbaugh is that he was a mechanic in a country village near Harrisburg, Pa. He was ingenious but not inventive, and loved to display his mechanical skill before the farmers and villagers. He was a trailer of inventors. More than forty instances of his imitative habit were shown at the trial, and he was severely scored by the judge, who accused him of "deliberately falsifying the facts." His ruling passion of imitation, apparently, was not diminished by the loss of his telephone claims, as he came to public view again in 1903 as a trailer of Marconi.

Drawbaugh's defeat sent the Bell stock up once more, and brought on a Xerxes's army of opposition which called itself the "Overland Company." Having learned that no one claimant could beat Bell in the courts, this company massed the losers together and came forward with a scrap-basket full of patents. Several powerful capitalists undertook to pay the expenses of this adventure. Wires were strung; stock was sold, and the enterprise looked for a time so genuine that when the Bell lawyers asked for an injunction against it, they were refused. This was the hardest blow that the Bell people received, in their eleven years of litigation; and the Bell stock tumbled thirty-five points in a few days. It was a time of jubilee for the claimants. Infringing companies sprang up like gourds in the night. And all went merrily with the promoters until the Overland Company was thrown out of court, as having no evidence except "the refuse and dregs of former cases—the heeltaps found in the glasses at the end of the frolic."



ALEXANDER GRAHAM BELL.

But even after this defeat for the claimants, the frolic was not wholly ended. They next planned to get through politics what they could not get through law, and induced the United States Government to bring suit for the annulment of the Bell patents. It was a bold and desperate move, and enabled the promoters of paper companies to sell stock for several years longer. The whole dispute was reopened, from Gray to Drawbaugh. Every battle was refought and in the end, of course, the Government officials learned that they were being used to pull telephone chestnuts out of the fire. The case was allowed to die a natural death, and was informally dropped in 1906.

In all, the Bell Company fought out thirteen lawsuits that were of national interest, and five that were carried to the Supreme Court in Washington. It fought out 587 other lawsuits of various natures, and with the exception of two trivial contract suits, *it never lost a case.*

Its experience is an unanswerable indictment of our system of protecting inventors. No inventor had ever a clearer title than Bell. The Patent Office itself, in 1884, made an eighteen months investigation of all telephone patents, and reported that "it is to Bell that the world owes the possession of the speaking telephone." Yet his patent was continuously under fire and never at any time secure. Stock companies whose paper capital totaled more than $500,000,000 were organized to break it down; and from first to last the success of the telephone was based much less upon the monopoly of patents, than upon the building up of a well organized business.

Fortunately for Bell and the men who upheld him, they were defended by two master lawyers who have seldom if ever had an equal for team work and efficiency—Chauncey Smith and James J. Storrow. These two men were marvelously well mated. Smith was an old-fashioned attorney of the Websterian sort—dignified, ponderous

and impressive. By 1878, when he came in to defend the little Bell Company from the towering Western Union, Smith had become the most noted patent lawyer in Boston. He was a large, thickset man, a reminder of Benjamin Franklin, with clean-shaven face, long hair curling at the ends, frock coat, high collar and beaver hat. Storrow, on the contrary, was a small man, quiet in manner, conversational in argument and an encyclopedia of definite information. He was so thorough that when he became a Bell lawyer he first spent an entire summer, at his country home in Petersham, studying the laws of physics and electricity. He was never in the slightest degree spectacular. Once only, during the eleven years of litigation, did he lose control of his temper. He was attacking the credibility of a witness whom he had put on the stand, but who had changed his views, not to the surprise of the opposition lawyers. "But this man is your own witness," protested the lawyers. "Yes," shouted the usually soft-speaking Storrow, "he *was* my witness, but now he is *your liar*."

T. D. LOCKWOOD.

The efficiency of these two men was greatly increased by a third—Thomas D. Lockwood, who had been chosen by Vail in 1878 to establish a Patent Department. A year before, Lockwood had heard Bell lecture in Chickering Hall, New York, and was a "doubting Thomas." But a closer study of the telephone transformed him into an enthusiast. Having a memory like a filing system, and a knack for invention, Lockwood was well fitted to create such a Department. He was a man born for the place. And he has seen the number of electrical patents grow from a few hundred in 1878 to 80,000 in 1910.

These three men were the defenders of the Bell patents. As Vail built up the young telephone business, they held it from being torn to shreds in an orgy of speculative competition. Smith prepared the comprehensive plan of defense. By his sagacity and experience he was enabled to mark out the general principles upon which Bell had a right to stand. Usually, he opened the case, and he was immensely effective as he would declaim, in his deep voice—"I submit, your Honor, that the literature of the world does not afford a passage which states how the human voice can be electrically transmitted, previous to the patent of Mr. Bell." His death, like his life, was dramatic. He was on his feet in the courtroom, battling against an infringer, when in the middle of a sentence, he fell to the floor, overcome by sickness and the responsibilities he had carried for twelve years.

Storrow, in a different way, was as indispensable as Smith. It was he who built up the superstructure of the Bell defense. He was a master of details. His brain was keen and incisive, and some of his briefs will be studied as long as the art of telephony exists. He might fairly have been compared, in action, to a rapid-firing Gatling gun, while Smith was a 100-ton cannon, and Lockwood was the manufacturer of the ammunition.

Smith and Storrow had three main arguments that never were, and never could be, answered. Fifty or more of the most eminent lawyers of that day tried to demolish these arguments and failed. The first was Bell's clear, straightforward story of *how he did it*, which rebuked and confounded the crowd of pretenders. The second was the historical fact that the most eminent electrical scientists of Europe and America had seen Bell's telephone at the Centennial and had declared it to be *new*. And the third was the very significant fact that no one had challenged Bell's claim to be the original inventor of the telephone until his patent was *seventeen months old*.

The patent itself, too, which had been writen by Bell, was a remarkable document. It was a Gibraltar of security to the Bell Company. For eleven years it was attacked from all sides, and never dented. Printed in full it would make three pages of this journal, but the core of it is in the last sentence—"THE METHOD OF, AND APPARATUS FOR, TRANSMITTING VOCAL OR OTHER SOUNDS TELEGRAPHICALLY, BY CAUSING ELECTRICAL UNDULATIONS, SIMILAR IN FORM TO THE VIBRATIONS OF THE AIR ACCOMPANYING THE SAID VOCAL OR OTHER SOUNDS." This sentence expressed an idea that had never been written before. It could not be evaded or overcome. There were only thirty-two words in it, but in six years these words had become worth a million dollars apiece.

Now the clamor of this great Patent War has died away, it is evident that Bell received no more credit and no more reward than he deserved. There was no telephone until he made one, and since he made one, no one has found out any other way. Hundreds of clever men have been trying for more than thirty years to outrival Bell, and yet every telephone in the world is still made on the plan that Bell discovered.

No inventor who preceded Bell did more, in the invention of the telephone, than to help Bell indirectly, in the same way that Fra Mauro and Toscanelli helped in the discovery of America by making the map and chart that were used by Columbus. Bell was helped by his father, who taught him the laws of acoustics; by Helmholtz, who taught him the influence of magnets upon sound vibrations; by Koenig and Leon Scott, who taught him the infinite variety of these vibrations; by Dr. Clarence J. Blake, who gave him a human ear for his experiments, and by Joseph Henry and Sir Charles Wheatstone, who encouraged him to persevere. In a still more indirect way, he was helped by Morse's invention of the telegraph; by Faraday's discovery of the phenomena of magnetic induction; by Sturgeon's first electromagnet; and by Volta's electric battery. All that scientists had achieved from Galileo and Newton to Franklin and Simon Newcomb, helped Bell in a general way, by creating a scientific atmosphere and habit of thought. But in the actual making of the telephone, there was no one with Bell nor before him. *He invented it first and alone.*

J. J. STORROW.

[EDITOR'S NOTE.—This is the eighth and last part of a series of telephone articles by Mr. Casson on the History of the Telephone. The former parts dealt with "The Telephone and the Telephone System," "The Development of the Telephone Exchange," and "The Telephone in Foreign Countries." The first article appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, July 9, 1910. These articles have attracted widespread attention and will form a part of a more extended study of the history of the telephone soon to appear in book form.]

TELEPHONE ORGANIZATION AND THE POSTOFFICE IN ENGLAND.

A CANDID REVIEW OF THE BRITISH SITUATION.

In Great Britain the Post Office Department controls not only the mails, but practically all electrical means of communication between and within the communities of the United Kingdom. Thus the telegraph system is an absolute government monopoly, wireless telegraph stations are established only in accordance with government licenses, many telephone lines are already operated by the government and practically all remaining telephone systems now operated by the National Telephone Company will soon pass under the complete jurisdiction of the Post Office Department.

Naturally this concentration of the entire means of communication under the control of this one government department has aroused considerable discussion as to its effect on the nature of the services rendered.

A very candid criticism of the British telephone policy was recently contributed to the London *Times*, and as it clearly points out the dangers of government ownership, even in a country where government ownership in many of the public utilities has had considerable success, it is given in full below:

TO THE EDITOR OF THE TIMES:

Major O'Meara's discovery of telephonic America is highly interesting, though it comes a little late. Nobody can fail to admire the gallant major's candid admiration of American telephone organization and of the results achieved thereby; but, considering the nearness of New York and London nowadays and the flood of general communication and of technical literature which flows across the Atlantic, it is a little strange, even diverting, to those familiar with conditions on both sides that a real appreciation of these things should have taken so long to penetrate to the Post Office.

In my humble way I have endeavored for some time past to show that efficient organization is necessary for the efficient handling of telephone traffic. I have long enjoyed friendly relations with the engineering department of the Post Office, and on two occasions during the past fifteen years I have offered to provide full information on the organization and methods of working of the American long-distance service, which has always been the most efficient in the world. My offer was at first cordially received—and, however much one may deplore the apathy of the general organization of the Post Office, it is right to say that the engineering department has always been alert and highly skilled and open to consider suggestions. In a higher quarter, however, it was decided that the Post Office did not want expert information on telephone organization. At the time the first of these offers was made, the Post Office had absolutely no telephone organization and was about to take over the trunk lines.

It is not on any personal grounds that I mention these incidents, but because they are typical of the unwillingness of the official mind to receive information or to learn from the experience of others, which is so potent a cause of stagnation and inefficiency in technical industries under government management.

Now that the Post Office discovery of telephonic America has been publicly recorded in such enthusiastic terms, you say, sir, that there are grounds for hope of reform. I venture to doubt it. Some improvement may, perhaps, be made, but it is impossible to attain commercial efficiency of organization under government conditions of employment and management. Both at the top and at the bottom there are fundamental causes which necessarily make for low efficiency, and under existing political conditions there is no cure.

In the past fifteen years we have had seven postmasters-general. Probably not one of them had ever been inside a telephone exchange or a telegraph office before he became postmaster-general. Yet the postmaster-general immediately becomes invested with supreme power over subjects which many able men, presidents and general managers of telegraph and telephone companies have spent their working lives in mastering; his word becomes law on matters with which he is wholly unfamiliar; in a night he becomes supreme arbiter of a great organization whose work is replete with technicalities. Small wonder that he often makes havoc with business questions of great moment. The entire telephone industry of the country has been harassed and held back owing to the fads of various politicians who have filled the office of postmaster-general. Only the other day the present holder of the office made in the House of Commons the most extraordinary statement regarding the future telephone finance of the Post Office. He said that after the purchase of the National Telephone system the entire telephone capital would be "swept away," and future capital expenditure would be treated as current expenditure. Where the postmaster-general is going to sweep away £25,000,000 he did not explain. A chairman of a public company who made such a statement or advocated such a system of finance as obtains with respect to the Post Office telegraphs would be invited to take his departure; but the House of Commons periodically listens to such statements regarding the finance of great state technical industries with hardly a word of protest.

The Post Office telegraph and telephone undertaking suffers from inexpert and inexperienced general management. The chairman or general manager of a telegraph or telephone company who has spent his life at the work is substituted, in the case of the Post Office, by a politician who, as a rule, has no knowledge either of the technics of the concern he is called on to manage or of business finance. This is a radical defect of organization from which there is no escape so long as the head of the Post Office must be a party politician.

I will pass over the watertight-compartment system of organization and the reams of foolscap and series of "approvals" necessary for every little operation, so destructive of efficiency and so productive of unnecessary work; these are familiar features of every government department and are apparently incurable. Without them the government never could spend the money it does on its work, and one important object of a British government seems to be to spend the nation's money.

But at the bottom there is another radical defect absolutely incompatible with efficient organization. In a commercial organization not merely an employee's promotion but his position depends on his efficiency. If he is not efficient he goes, sooner or later, according to the standard of management; but he goes. In a government department employment is permanent, and this inevitably produces a low grade of efficiency throughout the staff. Man is so constituted, the greater number of him, that he works when he has to do so and just as much as he is compelled. Even in commercial life a large proportion of employees show remarkable perspicuity in gauging the minimum amount of work which will enable them hold their jobs. In government employ permanency of employment develops this natural tendency to the extreme, and I doubt if it is exaggerating the case to say that a government department with an "established" staff employs twice as many people as a commercial organization would employ to do the same amount of work. This inevitably reacts on the general efficiency of the staff and on the quality of the work.

In the Post Office we have the additional evil that the staff has of late years formed itself into a political organization which wields great political influence throughout the country. Hardly a member of the House of Commons escapes the pressure and the importunities of the Post Office staff conscious of its voting power, and the frequent large increases of the wages bill of the Post Office are the result. The proceedings at the numerous conferences of the various Post Office trade unions and the columns of the staff organs are ornamented with expression of disrespect and disloyalty towards the official chiefs which would be inconceivable from the staff of a private concern, and show how much discipline has been undermined by the success which has attended steady political agitation.

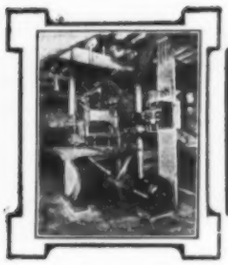
It is idle to expect that a great technical industry shall be operated either efficiently or economically under political control. There are fundamental reasons, outlined above, why, so long as political control is the governing factor, both real economy and real efficiency are unattainable under government management.

The extraordinary thing is that although the Post Office telegraph undertaking has been such a colossal financial failure—it has lost £18,000,000 of public money in forty years and is now losing nearly £1,000,000 a year—and although every member of the House of Commons resents the methods of the Post Office staff, yet Parliament apparently acquiesces in the transfer of another great electrical industry to the Post Office. When the National Telephone system is transferred to the Post Office an addition of some £15,000,000 will be made to the telegraph and telephone capital of the Post Office, which will quickly, as happened with the telegraphs, become unremunerative. Also, the Post Office staff will be swelled by some 18,000 people, very alert, intelligent and well-trained people, who already possess a semipolitical organization of their own, formed in view of the approaching transfer. One pities the fate of the member of parliament when the staff of the National Telephone Company shall be added to the existing staff of the Post Office.

One can only explain the acquiescence of Parliament in the proposed transfer on the supposition that the great majority of members are unacquainted with the state of Post Office telegraph and telephone finance and do not realize the political bearing of adding a highly-organized body of 18,000 people to the Post Office staff.

HERBERT LAWS WEBB.

35 Old Queen Street, London, S. W.,
July 22, 1910.



Industrial Power

Earthed Concentric Cables in Coal Mines.

At a meeting of the Lancashire Section of the (British) Association of Mining Electrical Engineers, on May 28 last, W. Bolton Shaw read a paper on "The Earthed Concentric System for Direct-Current Colliery Cables," in which the following advantages of this system were noted: (1) Concentric cables were preferable to separate cables for each pole, on the score of cheapness and compactness, as well as less self-induction; they were also preferable to single cables with twin conductors. (2) If the outside earthed metallic layer or armoring is used as one of the current-carrying conductors, the cable can be made as a single-core armored cable, which was the arrangement favored by the author for direct-current colliery work. (3) It practically halved the fuse and switchgear, making it single-pole, and reduced the risk of breakdown and cost of repairs. (4) It reduced the risk of danger by making continuity of the armoring one of the essentials to supply. (5) Leakage was easier to detect, as it led to a complete short-circuit quicker, and isolated the faulty circuit, and the author opined that the risk of fire from a momentary short-circuit confined within an earthed envelope was less than from continued leakage. (6) The armoring also provides a substantial visible conductor to which motor frames, switches, cases, etc., can be connected for earthing.

The principal disadvantage of the system is the fact that, as the armoring carries current, there is a fall of potential along it. If, therefore, the system is earthed only at the negative bar on the main switchboard as it ought to be, there will be an appreciable difference of potential between the far end of the armoring and earth, and this may be sufficient to cause slight sparking on contact between the cable and pipes, rails, etc. A light form of insulation, such as a layer of compounded jute, can be used to obviate this, although, if motor frames are earthed to the cable, the objection may still apply.

A substantial earth connection should be made to the negative busbar on the main switchboard, and taken to two independent earths. The negative terminals of the generators should be connected to the bar through circuit-breakers, but there must be no other joint on the negative side where the circuit can be broken. All motor-starters, etc., must, of course, be on the positive side.

The Formation of Nitrous Oxide and the Properties of Short Direct-Current Arcs with Cooled Electrodes.

The formation of nitrous oxide in a short direct-current arc with hot cathode and cold anode has been the subject of an extensive investigation by Dr. Wilhelm Holweck. He obtained about eighty grams HNO_3 per kilowatt-hour and demonstrated that the shortest arc produces the greatest concentrations with minimum gas velocities (maximum concentration nine per cent NO and more in air). The electrical conditions in the arc were investigated by means of an iridium probe, and it was ascertained that in an arc which is cold at the anode and free of electrode vapor, the field remains constant in the vicinity of the electrodes. The stronger the field, the higher become the output and the maximum attainable concentration, so long as the temperature of the arc is not too high. If the temperature rises too high, the thermal conditions annul the electrical and the maximum concentrations show less favorable values. As the fall of potential at anode and cathode is limited to the closest vicinity of the electrodes, it cannot be considered of influence on the output. It cannot even affect the thermal conditions, as the temperature close to the electrodes is dependent on outside influences. Therefore, only the watt consumption in the path of the gas can be the determining factor, and this consumption is governed in the first place by a high value of the field strength. When we consider that arcs employed in practice work with a fall of potential in the light column of less than ten volts per centimeter, the field strength of 100 to 200 volts per centimeter manifesting themselves with these short arcs will appear relatively very high. The yield of the arcs employed in practice with ten volts per centimeter, as is well known, amounts to about sixty to seventy grams HNO_3 per kilowatt-hour; the arcs of more than 200 volts per centimeter here investigated agree with these results. The concentrations attained with high field strengths are more favorable than those reached in practice with small field strengths; for with sixty grams of HNO_3 per kilowatt-hour 3.5 to 4 per cent of NO was obtained. This would seem to demonstrate that the arc used in practice is characteristic of the thermal, and the very short arc here investigated of the electrical formation of NO, for the temperature of the short direct-current arc here employed was so low that the points of the finest iridium probes were not softened. — *Translated and abstracted from the Zeitschrift fuer Elektrochemie, Halle, June 1.*

The Possibilities of the Asynchronous Motor.

The course of development of the asynchronous motor from the original closed-circuit machine to the latest form of this motor with slide rings and self-locking starting device built in it is critically discussed by J. Fischer-Hinnen in the *Electrotechnische Zeitschrift* for July 14, 1910. From his observations he draws the conclusion that in the near future the motor with rotating resistances will assume greater importance. A machine of this kind of the latest improved construction built by the Oerlikon Company is described and illustrated in detail. The various starting methods are also discussed.

The Work of the Sanitary District; the Wilmette Pumping Station.

The drainage canal and incident works of the Sanitary District of Chicago have attracted the attention of engineers for several years. Of chief importance has been the method thus employed of securing a pure water supply for a city of this size. Previous to the beginning of this work the sewage of the entire city was discharged into the harbor directly, or through the Chicago and Calumet Rivers. This condition of sewage pollution led to severe epidemics of typhoid fever, and Chicago had an unenviable reputation for this disease. Long and serious study of conditions by both engineers and sanitarians led to the determination of the system finally adopted for removing the trouble.

This consisted in the construction of a canal, about twenty-eight miles long, connecting the Chicago and Desplaines Rivers, striking the latter near Lockport. By this means the direction of the flow of the Chicago River was reversed and the waters of Lake Michigan were used to dilute the sewage, which later finds its way to the Mississippi River.

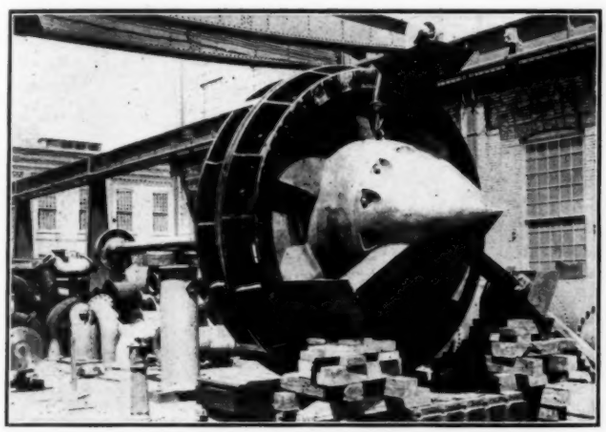
Upon the completion of the canal proper further safeguards were carried forward, first the building of an intercepting sewer along the lake shore on the south side of the city, extending as far south as Eighty-seventh Street and covering all that section included up to the Chicago River. At Thirty-ninth Street a pumping station was built which not only handled the sewage collected by the intercepting sewer, but also took large quantities of water from Lake Michigan and discharged it with the sewage into the south branch of the river, thus tending to maintain a current which would keep it free from any dangerous or disagreeable condition.

This station contains four Allis-Chalmers centrifugal pumps for handling sewage, and two screw pumps for taking the water from the lake. It has a total capacity of 2,100,000,000 gallons per twenty-four hours, which is the largest pumping capacity of any single plant in the world. After this was completed, work was started on the Lawrence Avenue station, which handles the sewage from the intercepting sewer along the north shore of the city and also takes water from Lake Michigan and discharges it into the north branch of the Chicago River.

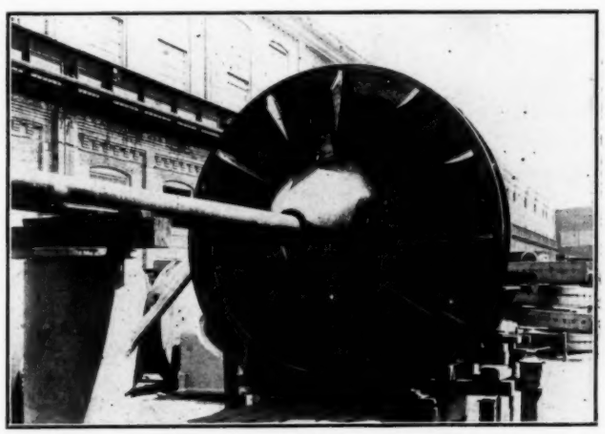
Besides these projects already completed, the district now has under construction what is known as the north shore channel on which will be located the Wilmette pumping station. There is also in contemplation a plan for the reversal of flow in the Calumet River at the south of the city, and when this is completed, together with certain sewage pumping stations which the city itself maintains, the entire shore front of Chicago and its immediate vicinity will be well protected.

The construction of the north shore channel is progressing quite rapidly now and probably within the course of the present year will be completed and in operation. This channel takes water from Lake Michigan near Wilmette and discharges it into the north branch of the Chicago River. From the lake to Sheridan Road, a distance of about 400 feet, the water will flow by gravity. Here a viaduct carries this road across the canal channel, and built as a part of the viaduct and beneath it, is the pumping station and a lock. This lock will be used for allowing barges and tugs, used in keeping the channel free, to go into the lake for discharging their loads. The bridge proper will consist of a steel framework faced with Bedford stone, thus giving the appearance of a stone bridge. It will have a paved roadway forty-six feet wide and two sidewalks each eight feet wide, with ornamental stone railings.

Beneath the center span of the bridge will be located the pumping station. This will consist of a motor room and transformer room, each twenty-nine feet by fifty-four feet, inside dimensions. Four horizontal screw pumps, each having a capacity of 15,000 cubic feet per minute against a head of three feet when running seventy-five revolutions per minute, will be installed, and views of one of these, taken at the shops of the manufacturers, the Allis-Chalmers Company, Milwaukee, Wis., are shown herewith. Each of these pumps will be driven by a 150-horsepower, three-phase, sixty-cycle, 2,300-volt induction motor. The pump runners will be located on the easterly side of the building with the shafts extended in a horizontal direction into the motor room.



SCREW PUMP, SUCTION SIDE.



SCREW PUMP, DISCHARGE SIDE.

Farming by Artificial Light.

Experiments are being made by D. A. Walker, near Cotulla, Tex., as to the effect of artificial light on the growth of vegetation. Power will be supplied to Mr. Walker's place from a private hydroelectric installation and will be transmitted to all parts of the farm. Tungsten lamps spaced 150 feet apart will supply light to the fields at night, a process which it is believed will greatly stimulate the growth of the farm products. D.

BOOK REVIEWS.

"Twentieth Century Hand-Book for Steam Engineers and Electricians." By Calvin F. Swingle. Chicago: Frederick J. Drake & Company. Morocco, 1,513 pages (4½ by 6½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

This book is a practical, non-technical treatise on the care and management of steam engines, boilers and electric machinery. The manner in which subjects are treated should appeal to engineers in charge of steam plants, as practically every type of apparatus found in such a plant is treated in detail, the best operating methods being fully described. Space is also devoted to the design, construction and erection of steam machinery gas engines, air compressors, and electric and hydraulic elevators, these subjects being treated as thoroughly as is possible in a popular way. The section on electricity considers only the machinery and apparatus found in a power plant but is very thorough in its treatment. The author also devotes a generous portion of the book to steam turbines, presenting a plain, practical description of each of the leading types of steam turbines now in use, including an explanation of the principles controlling their action, together with rules and instructions for guidance in their operation. In order to facilitate the study of the different subjects treated a series of practical questions and answers follow the close of each section.

"Electric Wiring." By Joseph G. Branch. Chicago: Branch Publishing Company. Cloth, 287 pages (5 by 7¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

This book is rather complete, containing 287 pages of reading matter and 100 illustrations, descriptive of outside and interior electric wiring, power plant work, surface and elevated electric railway circuits, telegraphy, wireless telegraphy and telephony and direct and alternating-current properties. These phenomena are described so as to make clear to the reader the principles involved in a practical way. However, the author seems to be a firm believer in the catechistic method of instruction as an effective means of injecting technical knowledge into the mental processes of workingmen. Such indirect exposition results in a very diluted and oft-repeated presentation of the most elementary things. That may be a successful way of assisting in the memorizing of definite statements of phenomena, but it does not seem like an effective means of inducing the workingman to think, to plan and to understand the reasons behind the work he does. For the most part the impressions are correct and the ideas clearly expressed. There are, however, occasional passages where a happier expression would remove some little ambiguity.

"The Art of Aviation." By Robert W. A. Brewer. New York: McGraw-Hill Book Company. Cloth, 253 pages (5¼ by 8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.

This work is intended to deal more with the practical aspect of flying machines than the theoretical, and it is therefore written with the object of interesting the public in general. The descriptive matter is condensed as much as possible, a number of excellent detailed illustrations portraying the various types of construction. There are a number of tables throughout the book and in the Appendix, which should prove of some use in working out aeroplane problems.

"Fuel and Refractory Materials." By A. Humboldt Sexton. New York: D. Van Nostrand Company. Cloth, 364 pages (4½ by 7 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

This is the second edition of a comprehensive treatise on all types of fuel, embodying tests and explanations which will materially benefit the reader. While the scope coverd by this edition is practically the same as the first edition, the chapters dealing with coke ovens, gas producers and pyrometry have been revised and enlarged to fully cover the latest practices. The modern forms of plant and apparatus are described while descriptions of some of the older types have been omitted. The book covers such subjects as combustion, heating power of fuels, coal washing, liquid fuels, gaseous fuels, pyrometry, testing fuels, and notes and tables.

"Electricity." By H. B. Hobart. New York: D. Van Nostrand Company. Cloth, 207 pages (5¼ by 8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

While this book is intended for engineering students it should also prove of value to those already engaged in the profession, owing to the practical subjects considered. While the subjects treated are practical the method of treatment is necessarily technical and mathematical calculations enter largely into the work. Departing from the usual style of text books covering the subject of electricity generally, this book omits descriptions of the historical conceptions in electricity such as the pith ball, loadstone etc. Problems involving essential cost factors have also been thoroughly treated. The following subjects are also discussed in detail: The generation and conduction of electricity; copper, aluminum and other conducting materials; energy; the Kelvin; electricity; continuous electricity and Ohm's law; the magnetic field; conductors moving in a magnetic field; alternating electricity; inductance; the magnetic circuit and insulating materials.

Good Roads Convention.

The third National Good Roads Convention will be held in St. Louis, Mo., on October 6, 7 and 8 next. This convention is under the auspices of the American Automobile Association, National Grange, Farmers' Union, American Road Builders' Association, United States Office of Public Roads, and the National Association of Automobile Manufacturers. The entertainment will include a banquet, steamboat excursion, and automobile trips. Chairman George C. Diehl has secured promises of attendance and addresses by men who have devoted years to road building and who have studied the changing conditions of traffic in all its new phases. Invitations to attend the convention will be sent by President L. R. Speare, of the American Automobile Association, on behalf of the committee in charge of the convention, to the governors of states, mayors of cities, state highway commissioners, park commissioners of cities, county commissioners and town highway commissioners throughout the entire country, as well as to officers of farmers' organizations, automobile clubs, automobile and vehicle manufacturers and other interests involved in road making and road machinery.

A hydroelectric power plant at Aztec, N. M., was recently temporarily shut down on account of the damage done by beavers to the retaining dam. Under the game-protection laws of New Mexico these animals have become so numerous as to be an absolute menace to property. D.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE UNION ELECTRIC COMPANY, Freeport, Ill., will do the electrical work on the court house. The company has a number of contracts on which it is working at present.

THE WHEELER-GREEN ELECTRICAL COMPANY, of Rochester, N. Y., has been awarded the contract for wiring, for electric service, the Niagara Falls state armory. The contract price was $2,646.

THE SCHMIDT ELECTRIC COMPANY, Clinton, Iowa, has received the contract for wiring the streets of Clinton for the new lights in West Second Street. The Poeple's Light Company will furnish globes and fixtures, and the Davenport Machine and Foundry Company will supply the posts.

THE ELECTRICAL EQUIPMENT COMPANY, of Laporte, Ind., was recently organized to do a general electrical contracting and supply business in that city. George H. Engstrom, who has been with the Laporte Electric Company for a number of years, will be president. Edward Kanney will be secretary and treasurer of the company.

THE READING ELECTRIC COMPANY, Reading, Pa., has received the contract for the electrical wiring of the new Berks County Trust Company Building amounting to upwards of $6,000. Aside from the wiring for lighting, the contract embraces the installation of complete telegraph and telephone systems and clock connections. The same company received the contract for the installation of a complete lighting system in the former Mt. St. Michael's Seminary, at Hyde Park, which is to be used as a retreat for Sisters. The contract includes a ninety-horsepower Fairbanks-Morse engine and a generator with storage-battery equipment and a high-pressure Perry pumping system, so that the entire building will have fresh water equal to city pressure. The contract also includes wiring for light and installation of fixtures. The company has the contract for the addition to the American House Hotel and the addition to Calvary Reformed Church, both calling for an extensive system of wiring and fixtures of special design.

Deposits of Rare Metals in the United States.

The recent increased demand for certain rare metals, such as tungsten, which is used in electric lamps and in hardening steel, has given great interest to the search for deposits containing them. Some of these metals, as platinum and nickel, are especially rare in the United States.

The United States Geological Survey publishes every year a bulletin containing many short papers and preliminary reports on mineral deposits examined by its geologists during the preceding year, and for the convenience of those who may be interested in deposits of particular kinds this bulletin is first published in parts or advance chapters, each one devoted to a single metal or mineral or group of metals or minerals. The short reports of explorations made in 1909 are contained in Bulletin 430 and the advance chapters are numbered 430-A to 430-J. Bulletin 430-D, containing reports on deposits of rare metals, is now ready for distribution. It can be had by applying to the Director of the Geological Survey, Washington, D. C. This pamphlet contains eight reports by six geologists, dealing with deposits of cinnabar, molybdenite, tungsten, chromite, monazite, platinum, and rutile.

Howland Bancroft presents reports on cinnabar (an ore of quicksilver) in Yuma County, Ariz., on platinum in southeastern Nevada, and on tungsten near Deer Park, Wash. J. M. Hill also makes a report on tungsten minerals near Calabasas, Ariz. Deposits of rutile in Virginia are described by T. L. Watson and Stephen Taber. Rutile contains the metal titanium, which is used to alloy iron, steel, and copper, and in mantles and filaments for gas and electric lights. Titanium steel is especially adapted to making durable rails for railroads. Nearly 36,000 tons of titanium-steel rails were made in 1909.

A Few Things Worth Remembering.

In the economical management of generators, motors and other machinery, it would be well for beginners, as well as others more advanced, to bear in mind the following advice given by a big New York central-station manager the other day:

"When a new machine is installed, or an old one changed over, a sharp lookout should be kept. The bearings of the new machine should be well oiled, and extreme care taken to keep oil out of the armature and off commutators. Run the belt slack, if indirectly connected, at the beginning.

"At the start run the machine at light or no load for several hours. It could be a reliable type of generator, or motor, and yet have serious faults in setting up or in foundation.

"Never overload a new installation or certain trouble will result. Give it close attention, and remedy at once any running defects. Look out for variation in current and voltages. In a large generating plant trouble often comes suddenly. It is well to be always on the lookout, and act promptly and effectively.

"When through with a metal tool, it would be well to put it in its rack in order to avoid danger of field attraction. I always use a copper oil-can in preference to all others.

"Commutators and brushes need unfailing vigilance. I have found that the rest of a well-balanced machine takes care of itself.

"Do not monkey with a brush while it is working even if there are others on the same side. Bearings and field coils may be touched once in a while in order to test temperature. Be careful in the matter, though.

"I have made it a point, when handling a conductor, to see that no bodily circuit were formed. Do not be afraid of the rubber gloves. Use a handkerchief in keeping the hands in a dry condition.

"When the machine is stopped, it should be cleaned and put in condition for next run. Place over it a rubber covering.

"I wish to give one more pointer to the new engineer: Do not consider yourself the whole thing in the management of machinery. You're simply a fraction. The other fellows help to make up the unit."

Crude Oil to Operate this Plant.

Cleburne, Texas, will soon have a new electric power plant in which the two 250-horsepower engines will be operated by steam generated in oil-fired boilers. No chimneys are needed for this type of plant.

New Electrical and Mechanical Apparatus and Appliances.

Balancing Within One Per cent.

The subject of balancing is of the greatest importance to central-station operators. Hitherto the usual guarantee for balancer sets has been two per cent automatic regulation, the same as is commonly made on three-wire direct-current generators. It is therefore interesting to record that the Electric Machinery Company, of Minneapolis, Minn., has placed on the market a balancer set with a one-per-cent guarantee, which is believed to be the first equalizer guaranteed to work within this small degree of out-of-balance. Indeed, these balancer sets have on actual test frequently shown a much better result than the guarantee, and have kept the voltage within five-eighths of one per cent of the exact balance upon full load in the neutral in one direction and full load in the neutral in the opposite direction. These sets are intended for use on three-wire systems with two-wire 220 to 250-volt direct-current generators and are intended to replace three-wire generators. The balancer sets are guaranteed to operate from full load in one direction in the neutral to full load in the opposite direction in the neutral and automatically keep the voltage within one per cent of normal. This means that with 220 volts the high side will not go above 111 volts, nor the low side below 109 volts. In addition, where the system is out of balance for any extended time the voltage can be made exactly equal by means of the field rheostats. These advantages are of greatest importance to the candlepower and life of incandescent lamps.

Magnetite Arcs On Trial In Cincinnati.

In less than two years the contract for the electric lighting of the streets of Cincinnati, Ohio, will expire. As there has been an agitation for the better lighting of the streets, the Union Gas and Electric Company, which has the contract, has placed with the General Electric Company, a trial order for seventy-five magnetite arc lamps. These lamps have been installed on a series circuit including the lower part of Gilbert Avenue, Reading Road, Elsinore Avenue, Wood Street and parts of a number of other streets.

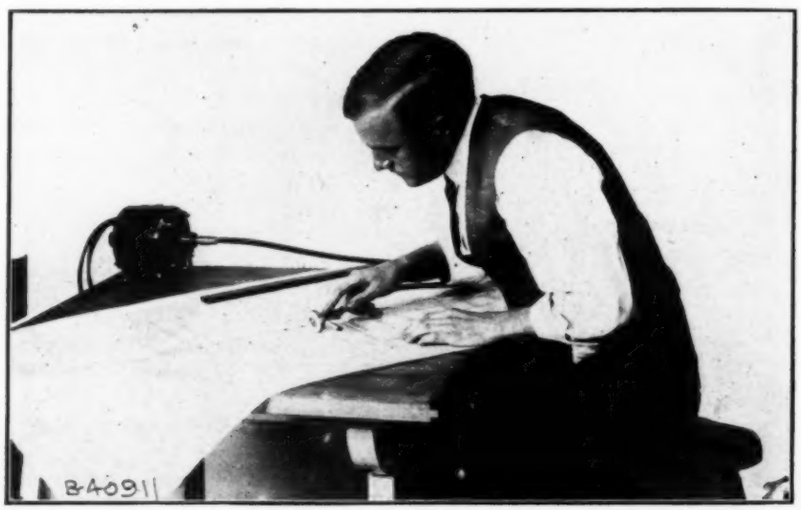
The new lamps are suspended twenty-two feet above the street level from an eighteen-foot mastarm. They will remain on trial indefinitely to give the city authorities and citizens a good idea of the improved lighting that the company is anxious to furnish when the contract is renewed for the next ten-year period. The lamps have aroused much favorable comment and it is very likely they will be adopted throughout the city. There are now used 5,856 arc lamps for street lighting for which the annual charge is $60 per lamp for part of the lamps and $72 per lamp for the balance. If the change is made throughout the city, it will involve an outlay estimated at between $750,000 and $1,000,000 by the lighting company in providing the lamps, new poles and mastarms, new regulators and mercury-arc rectifiers, besides other rearrangements.

Western Electric Company Rural Telephone Sales.

The Western Electric Company reports that during the past twenty months it has sold over a quarter of a million of the No. 1317 type rural telephones. This is an unprecedented figure for these sales, and it is a certain indication that the rural telephone movement is progressing rapidly.

Motor-Driven Eraser.

It is a fact well known to draftsmen that mistakes in inking tracings are not infrequent and that changes in design are frequently necessary so that alterations must be made in the tracings. With a light, fast motion, the ink may be removed without injury to the tracing cloth; but there are very few draftsmen who have the patience to do the work without putting too much pressure on the rubber. A rapidly revolving circular eraser, driven through a flexible shaft by a small motor, places at the disposal of every drafting room a perfectly satisfactory means of removing ink from tracings.



VIEW SHOWING APPLICATION OF WESTINGHOUSE MOTOR-DRIVEN ERASER.

The Westinghouse motor-driver eraser, shown herewith, is equipped with a one-twentieth-horsepower motor, running at 1,700 revolutions per minute, and taking power from any convenient lighting socket. The circular eraser is securely fastened in place by a wing to allow for renewals. A cleaning rubber is arranged to touch the rotating circular eraser very gently and remove the ink which would otherwise collect; adjustment is made by the movement of a sleeve on the handle of the erasing head. The flexible shaft is about three feet long, permitting a large tracing to be covered as the shaft can be bent in a curve of short radius.

The tendency of men unfamiliar with the outfit is to put too heavy a pressure on the eraser in the attempt to remove all traces of the ink from any given point by a single application of the rubber. This causes overheating which may be enough to spoil the drawing. It is better to go over the entire line to be removed very lightly and rapidly several times, and after a little practice the third application will ordinarily remove all traces of the ink.

A single erasing outfit is sufficient for any ordinary drafting room, as it is customary to locate the eraser permanently on one table, and bring all the work there. If preferred, the motor may be moved about from desk to desk as occasion requires, lighting or special sockets being provided in convenient places for connecting the motor to the circuit.

The complete outfit consists of a motor for either direct or alternating current, flexible shaft, three circular and three cleaning erasers. This equipment is manufactured by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

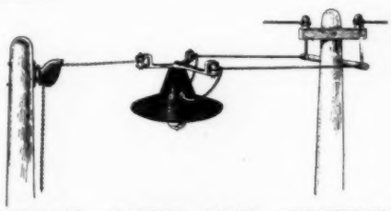
VIEW OF HOOD SHOWING LINE SUSPENSION.

World's Production of Calcium Carbide.

United States Consul-General Richard Guenther, of Frankfort, Germany. reports the world's production of calcium carbide in 1908 as amounting to 200,000 tons, one-fifth of which was produced in the United States and Canada. The production in the other countries was as follows, in tons: Italy, 32,000; France, 27,000; Norway, 25,000; Switzerland and Austria-Hungary, 20,000 each; Sweden, 12,000; Germany, 9,000; England, 800. There were seventy factories employed in the manufacture of the article. The production has increased very much in recent years.

The Federal Street Hood.

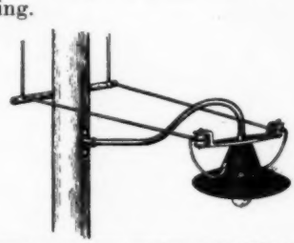
A practical, durable and low priced hood for outdoor lighting is being manufactured and placed on the market by the Federal Electric Company, Chicago, Ill. Views of this hood are shown in the accompanying illustrations.



FEDERAL STREET HOOD SUSPENDED. WITH PULLEY ATTACHMENT FOR LOWERING.

The Federal street hood has been designed to meet the demand for a low-priced outdoor fixture for tungsten lamps which are rapidly coming into use for street illumination. It is supported directly by the line wiring or with chain and pulley as shown in one of the illustrations. The support at three equidistant points makes the street hood perfectly stable and level. It cannot turn over nor be swung in such a manner as to break the tungsten filaments.

The hood consists of a steel cone seven inches high and a shade fifteen inches in diameter, painted with black enamel on the outside and white inside. The three-arm rigger is japanned iron, fitted with three insulators fastened by cotter pin and has a spread of twenty-two inches. The wiring enters the hood through two Federal porcelain bushings. The socket used will automatically close the circuit when the lamp burns out or is broken, so that all other lamps in the series remain burning.



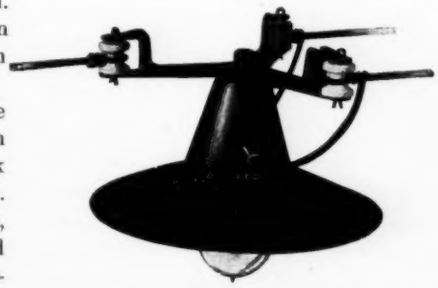
STREET HOOD WITH GOOSENECK.

One of the illustrations shows a combination which permits the suspension of the street hood over the street and provides for lowering to replace or inspect the lamp. The two lead wires form one side of the support and the third arm is supported by a chain or rope which passes over a pole pulley on a pole on the opposite side of the street. When the chain or rope is tightened the street hood is held firmly in position. It cannot sway about or turn over in a windstorm, but remains perfectly level, a matter of utmost importance when tungsten lamps are used, owing to their well known fragility.

Another illustration shows a street hood designed for use on pole brackets or mast arms. The hood is equipped with a two-arm rigger in place of a three-arm rigger and is suspended from a gooseneck. This outfit is particularly adapted for sidewalk lighting.

Electrical Equipment for English Steel Works.

The well-known British steel works of Dorman, Long & Company, Ltd., has ordered an entire new electrical equipment from a prominent German firm. The plant will consist of three mixed-pressure turbo-alternators and one live-steam turbine, each of 1,280 kilowatts, generating three-phase forty-cycle current of 3,000 volts at 2,400 revolutions per minute. There will also be two 600-kilowatt transformers, one 600-kilowatt direct-coupled generator, one induction motor direct coupled to one 150-kilowatt direct-current generator, complete with a switchboard having seventeen panels.



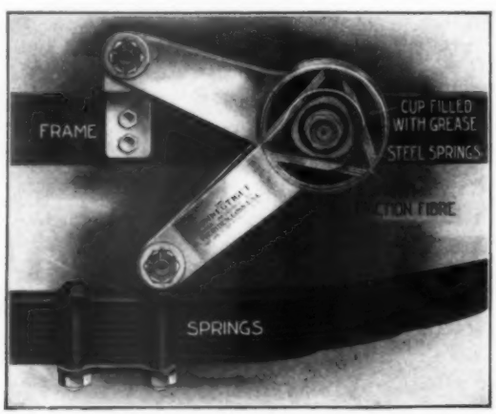
VIEW OF STREET HOOD EQUIPPED WITH THREE-ARM RIGGER.

The alternating current generated will be converted into continuous current, at a pressure of 120 volts, the intention being to close the existing continuous current power station, consisting of seven sets of 1,575 kilowatts output, which is now supplying the works. The turbine plant in the new power station will be driven chiefly by exhaust steam from three large rolling mills in the neighborhood.

The Connecticut Shock Absorber.

The Connecticut Shock Absorber Company, Meriden, Conn., has brought out something new in the line of a shock absorber for controlling the excessive action of automobile springs. This device is constructed along correct mechanical lines in every respect. By referring to the accompanying illustration it will be readily seen that the working parts consist of a three-face cam working between three sets of springs of suitable tension to give the necessary resistance for the different weights of cars. These springs are located in a triangular position inside the remaining shell or cup with a piece of special bone fiber inserted between the face of the cam and the spring so as to eliminate any possible wear. The case is packed with non-fluid oil, which surrounds the cam and springs, keeping them well lubricated at all times. The case is made grease tight, and it is therefore impossible for the grease to leak out or water or dirt to get in.

It will be noted that the construction is such that all of the strain comes on the cams, and the bearings for the cam hubs in the shell of the absorber receive practically no wear. This result is accomplished by the triangular arrangement of the springs and cam, which feature will be greatly appreciated, as it means a set of these absorbers placed on a car will last almost indefinitely.



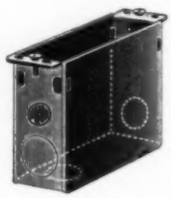
VIEW OF CONNECTICUT SHOCK ABSORBER INSTALLED ON A CAR.

An Electric Mine-Lamp.

A safety lamp for miners, recently put on the market by a British concern, employs a small incandescent lamp which is lighted by a primary battery.

"Union" Door-Switch Boxes.

The accompanying illustration shows the new "Union" door-switch box being manufactured and placed on the market by the Chicago Fuse Wire and Manufacturing Company, Chicago, Ill. These boxes are made for circular loom flexible cable and rigid conduit and can readily be inserted in any standard door jamb, the cover of the switch



UNION DOOR-SWITCH BOX.

effectively covering the switch and box.

Union door-switch boxes are made in accordance with the requirements of the Fire Underwriters. They are made in four sizes of fourteen-gage steel and are finished in black enamel.

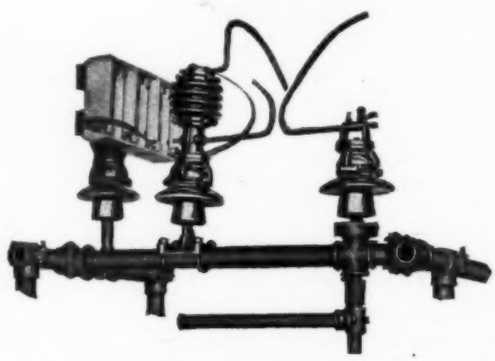
Sizes No. 1 and 3 are made for loom or rigid conduit. Two five-eighths-inch knock-outs are provided for flexible, non-metallic conduit and a knock-out in one end for rigid one-half-inch pipe. The inside dimensions of the box admit a one-half-inch conduit bushing.

Sizes Nos. 2 and 4 are made for flexible, metallic and rigid pipe having two holes eleven-sixteenth inches in diameter, arranged so as to have the flexible conduit securely anchored by the clamps furnished with the box. A knock-out for one-half-inch conduit is also provided which will permit the use of rigid conduit or flexible conduit fastened by bushing.

Aluminum Lightning Arresters For Underground Cables.

One of the most serious problems with which operators of underground cable systems have to contend is the protection of the cables against internal surges and against lightning in cases where the underground circuits are connected to overhead lines. During the past two years the General Electric aluminum arrester has been given a very wide application in the protection of cable and mixed overhead and cable circuits, in fact has practically superseded all other forms and with its recent improvements is still better adapted for this class of service.

One characteristic of the aluminum arrester which has an important bearing on this application is the daily charging of the cells—a process which consists simply of subjecting the stacks of aluminum cones to the line voltage and short-circuiting the series horn gaps for a brief period. This charging process as well as normal discharges resulting from high voltage disturbances is accompanied by a slight arcing at the horn gaps. On cable systems where the electro-static capacity is large compared with the inductance of the circuit, it is advisable to take every possible precaution to limit the charging current to a minimum value.



GENERAL ELECTRIC HORN GAP WITH CHARGING RESISTANCE FOR CABLE SYSTEM.

In the General Electric aluminum arrester this is accomplished by means of a special horn gap used in connection with a charging resistance. The resistance limits the charging current and even if the cells are in poor condition smooths out the wave shape of the current and damps out any tendencies to oscillate. At the same time it does not prevent the cells from

taking their full charge. These auxiliaries are so arranged as to give selective paths to the cells; one through a horn gap without resistance, which is the same as in the arresters for overhead circuits, and the other through a resistance and a horn gap, the setting of which is slightly less than that of the gap without resistance. With this arrangement the daily charging current and the average surge discharge take the path through the resistance. This resistance is adjusted to a value which will so modify the nature of the charging arcs that there is no liability of resonance occurring.

Heavy discharges which will be impeded somewhat by the resistance will be shunted through the principal horn gap and have a free path without resistance. The arc from this discharge, rising on the horns, will be intercepted by the horn blade which is connected to the resistance and hence the current is limited at the end of the discharge and as the arc breaks. Thus surging which would be produced by the breaking of a large current arc in air is entirely eliminated by having the arc and current suppressed. Thus the safety horn gap with the charging resistance combines a number of valuable features in safety of operation without in any way decreasing the efficiency of the arrester.

The Matthews' Telafault.

The Matthews' Telafault, a simple, self-contained and inexpensive cable test set, is designed for locating faults in telephone and telegraph cables. By means of this set low resistance crosses, grounds and shorts can be readily located by the novice, the location being within the fraction of an inch of the trouble.

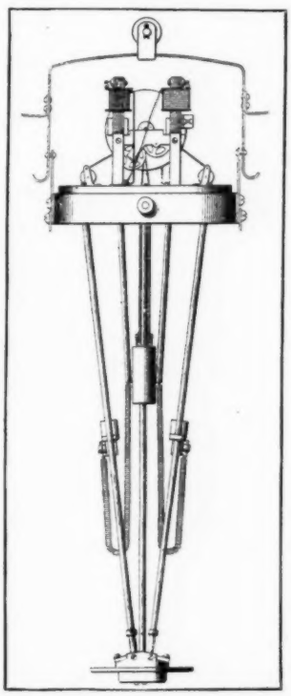
Even with the best of protection, it often happens that lightning will enter a cable. In many cases the trouble will be scattered through several pairs located along a considerable length of the cable. With the Wheatstone bridge and the ordinary Murray or Varley loop test this trouble can be located only approximately. The cable then has to be opened and tested both ways. Sometimes it is necessary to open the cable at several places before the faults are found.

The device described above is manufactured by W. N. Matthews & Brother, St. Louis, Mo.

The Stave Flaming Arc Lamp.

The accompanying illustration shows the alternating-current Stave flaming arc lamp, manufactured by the Stave Electrical Company, 27 West Twenty-seventh Street, New York. The view gives an idea of the details of the interior mechanism.

Flaming arc lamps are so called because of the chemical composition used in the carbons of these lamps, which produce an arc that resembles an open flame. Quite a few compositions are used, but the most successful ones contain a preponderance of calcium salts. The latest practice is to fill the shell of pure arc lamp carbons with a core of a combination of luminous salts. The light emitted by these carbons is generally of an agreeable warm, orange color.



MECHANISM OF STAVE FLAMING ARC LAMPS.

The downward inclined disposition of the carbons necessitated the construction of an entirely different type of lamp, and as the most suitable voltage for these carbons varies from forty-five to forty-seven volts, it was necessary to design an arc chamber with a very much greater sensitiveness than that used for the original open arc or for the inclosed arc. The luminous intensity of the flaming arc varies approximately as the square of current within certain limits, and it was necessary to design lamps in such a way that the slightest disturbance in the electrical conditions of the arc would be promptly and immediately taken care of.

Boroid—a Noninflammable Celluloid.

A demonstration was recently given to representatives of the English technical press, of the properties of "Boroid," a noninflammable form of celluloid. Various thicknesses of the new material were subjected to tests which, while productive of fire in the case of ordinary celluloid, proved the noninflammability of "Boroid." Lighted matches, cigarettes, and cigars placed against the substance produced no more than a black smoke, there being no sign of flare or flame. The material also withstood the heat rays from the condenser in a magic lantern. The "Boroid" specimen withstood the concentrated rays of a sixty-ampere arc light for ten minutes, and when examined showed no sign of burning, blistering, or discoloration of any kind. The celluloid specimen subjected to the same test fired in two seconds. The positive carbon, while red hot, was also held against the same piece of film, which merely melted and gave off a thin white smoke. The material has been produced mainly with the idea of its taking the place of celluloid in cinematograph films, but it can be molded into any desired shape. Samples of the material stamped out in rectangular plates about one-eighth inch thick to act as a substitute for window glass were shown. The material is stated to be a good insulator, and steps will be taken to produce imitation ivory and porcelain for electrical accessories.

Cost of Motor-Trucking.—Analysis of Scores of Philadelphia-Atlantic City Reliability Run.

The just-announced scores and detailed power and operating costs of the Philadelphia-Atlantic City Reliability Run for commercial automobiles, held August 12 and 13, furnish a most important chapter in the authoritative data on this subject, which is just now attracting widespread interest among business men.

The primary object of the run was to determine as closely as possible the cost per ton hauled per mile of all types of modern power trucks and delivery wagons over a course of sixty miles and return, under conditions

that closely approximated the actual work of power wagons on long suburban hauls.

The regulations of the race required that each car should carry its full catalogue weight in merchandise or other dead loading, and most stringent rules and observations surrounded the supplying of gosoline, lubricants and electric current for battery charging.

The maintenance of normal speeds was secured by a system of penalties for over-speeding and under-speeding. The cost per ton load carried per mile for each entrant was computed from elaborate, carefully checked weight and fuel consumption data by a well-known firm of Philadelphia accountants. Gasoline and electric vehicles were run in separate groups.

The following are the condensed scores published for each class and division:

MANUFACTURERS' DIVISION—GASOLINE.

Class A. (1½ tons capacity and less.)
Number of entrants—18.

	Cost per ton mile
Winning car, Franklin	$.01285
Second, Victor	.01756
Last, International Harvester	.06814

Failed to finish—3.

Class B. (Between 3,001 and 5,999 pounds.)
Number of entrants—1.

	Cost per ton mile
Winning car, Garfield	$.01990

Class C. (Between 3 and 4 tons.)
Number of entrants—5.

	Cost per ton mile
Winning car, Frayer-Miller	$.00765
Second, Standard	.00814
Last, Gramm	.01226

Failed to finish—2.

PRIVATE OWNERS' DIVISION—GASOLINE.

Class A. (1½ tons capacity and less.)
Number of entrants—26.

	Cost per ton mile
Wining car, Auto Car	$.00898
Second, Cartercar	.01044
Last, International Harvester	.05743

Failed to finish—2.

Class B. (Between 3,001 and 5,999 pounds.)
Number of entrants—2.

	Cost per ton mile
Winning car, Motor Commercial	$.01642

Failed to finish—1.

Class C. (Between 3 and 4 tons.)
Number of entrants—5.

	Cost per ton mile
Winning car, Frayer-Miller	$.00705
Second, Packard	.01238
Last, Reliance	.01757

Failed to finish—0.

ELECTRIC VEHICLE DIVISION.

Class A. (1½ tons capacity and less.)
Number of entrants—4.

	Cost per ton mile
Winning car, General Vehicle	$.01013
Second, Commercial	.01280
Last, Commercial	.01394

Failed to finish—0.

Class B. (Between 3,001 and 5,999 pounds.)
Number of entrants—3.

	Cost per ton mile
Winning car, General Vehicle	$.00706
Second, Commercial	.00966

Failed to finish—0.

Class C. (Between 3 and 4 tons.)
Number of entrants—2.

	Cost per ton mile
Second, General Vehicle	.00828

Failed to finish—0.

The following important facts may be deduced from these condensed data: First, the variation in cost per ton mile of gasoline cars of the same class reached as high as 637 per cent, seeming to indicate an enormous latitude in cost, dependent upon the individual driver's skill and care, and the design of the car. Second, thirteen per cent of the gasoline cars that started failed to finish. Third, the extreme variation in cost per ton mile with different makes of electrics was but thirty-seven per cent, showing extraordinarily consistent economy throughout this type. Fourth, the power cost of electrics is as low as the best recorded performance for gasoline, although the electrics were compelled to exceed their normal rated speed and mileage. Fifth, the least economical recorded performance of an electric vehicle is, in point of power cost alone, better than seventy-five per cent of all gasoline car scores. Sixth, every electric vehicle entered finished creditably.

It is also worthy of note that the General Vehicle Company's three-and-one-half-ton truck entered by Shane Brothers & Wilson spent eighteen minutes in hauling a ditched six-ton gasoline truck back on to the road, and despite this extra expenditure of current made a power economy record for the 120-mile run within four and one-half per cent of its competitor.

Exports for copper for the week ended August 11 were 6,233 tons. Since August 1, 11,888 tons. For the same time previous year 12,756 tons.

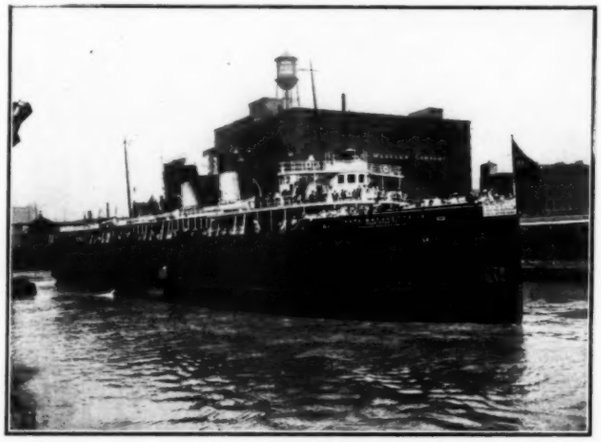
Total exports of copper for July, 23,018 tons; for the same month last year, 35,046 tons.

Flaming Arc Lamps on Lake Steamer.

An interesting application of flaming arc lamps, which has attracted a great deal of attention, is the installation on the steamer *Pere Marquette*, an excursion steamer operated by the Chicago Navigation Company between Chicago and southern Wisconsin ports.

For illuminating the upper decks, two Aurola flaming arc lamps are suspended by chain from each of the two masts. The lamps operate on a 110-volt direct-current circuit, current being supplied from the generating room in the hold. The lamps are installed in such a manner as to be easily lowered for trimming and cleaning.

Flaming arc lamps of the same type are also installed to illuminate the dance hall on the main deck. The installation has given good satisfaction and the officials of the company are said to be considering the equipping of other steamers with these lamps.



EXCURSION STEAMER EQUIPPED WITH FLAMING ARC LAMPS.

Although a great deal of rough weather has been encountered by the boat on its daily trips the lamps have burned continuously and no trouble has been reported.

The lamps were supplied by the Chas. L. Kiewert Company, 39 Cortland Street, New York, N. Y.

New York Line to Be Electrified.

The Jamestown, Chautauqua and Lake Erie steam road, which extends from Westfield to Jamestown, N. Y., thirty-seven and one-half miles, and which is operated by the Buffalo and Lake Erie Traction Company, has applied to the Public Service Commission, Second District, New York state, for permission to electrify.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 10.—The Austrian government is looking forward to adopting electric traction to a considerable extent on the railroads. The state railroad administration recently appointed a special commission in order to lay a basis for carrying out this idea, and it is intended to secure the fullest possible data both from a technical and a financial standpoint. It is probable that hydraulic power will be used for this purpose to a large extent.

In the Lombardy region of Italy there has been opened up a new electric railroad line from Brescia to Salo, and it is now running successfully with ten trains per day. An electric plant erected at Brescia furnishes the power for the new line.

Electric lighting projects are being considered at Villelonque, in the Pyrenees region of France, and also at Corbeil, in the neighborhood of Paris. In the south of France the town of Montelimar is engaged upon a project for a central lighting plant. Concessions have been granted to local companies in the towns of Neussages and Seyches. An electric plant will soon be erected at Fort de l'Eau, near Algiers.

In connection with the Brussels Exposition there will be held an international congress of Radiology and Electric Application during the month of September. The programme includes three sections, namely, physical questions, proper terminology and radiometry and applications to biological work.

The Southern Railroad Company of France is to carry out an extensive piece of work in applying electric traction upon a portion of the lines in the Pyrenees region between Pau and Montrejeau, and there is to be about 200 miles of double track railroad equipped, according to the present project. No less than four separate central stations are to be erected for this purpose, and they will be located at Eget, Soulom, Porta and Ossau. These four stations will furnish a total of 50,000 horsepower.

On the occasion of the industrial exposition at Turin in 1911 the chamber of commerce of that city will award a prize of $10,000 for an invention, discovery or application which will render a distinct service to the national industry. The concourse is international, and the papers can be drawn up in the French or Italian languages accompanied by plans or drawings. Machines are also admitted, provided these are not of too large size. The concourse will close on March 31, 1911.

On the Emme, an affluent of the Aar, there will be installed no less than three separate hydraulic plants, lying at different levels on the stream. The first plant will be located at Schupfheim, and use a 130-meter head of water. A dam of considerable size will be built at this point, and it is expected to obtain a maximum supply of 20,000 horsepower. The next plant at Entlebuch will furnish 3,000 horsepower, with a sixty-meter fall, while the third station, located at Runding, will be the largest and will give 72,000 horsepower, using a 150-meter head of water.

In Holland there is to be constructed an electric traction line from Kiel to the town of Kestern, running by the communes of Hienden and Mourik. A local firm has applied for the concession for the line. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

CONTRACT LET FOR TENNESSEE POWER PLANT.—The contract for the complete engineering and construction of the hydroelectric power plant for the Eastern Tennessee Power Company, has been awarded to J. G. White & Company of New York. The dam across the Ocoll River is to be 110 feet in height and 780 feet in length. Power equipment is to consist of four 3,000-kilowatt, three-phase, sixty-cycle generators, with the necessary exciters and auxiliary apparatus. The cost of the entire plant is estimated at $2,000,000.

BOULDER POWER PLANT IN OPERATION.—A short time ago the power plant of the Central Colorado Power Company at Boulder, Colo., was put in operation by Mayor Greenman of that city. The Boulder plant has been three and one-half years in course of construction and cost about $2,500,000. It is located along Middle Boulder Creek. Between the Barker Meadow dam and the power plant there is a stretch of twelve miles of mountain stream and canon. The Barker dam is said to be one of the largest dams in the world. It is 177 feet high, 621 feet long, 120 feet thick at the base and sixteen feet at the crest. 133,000 cubic yards of concrete were used in its construction. From the dam, which stores 525,000,000 cubic feet of water, a concrete conduit conducts the water twelve miles to the Kossler reservoir and from there a steel pressure pipe, 9,000 feet long, carries the water almost vertically down to the power plant, developing a pressure of 900 pounds to the square inch when it reaches the impulse wheels. Power is transmitted at a high voltage.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The New York Public Service Commission, First District, extended until September 5 the suspension of the order of April 5 requiring that the maximum headway in the subway during daytime non-rush hours should be two and one-half minutes. That order was adopted after careful study of service conditions, the facts ascertained having been presented at numerous hearings and conferences. Later on the Interborough Rapid Transit Company pleaded that there should be a let-up during the hot weather, when many people avoid the subway, particularly at hours when speed is not important. The commission suspended the operation of the order referred to for a period of thirty days from July 12, and the Interborough applied for an extension. The company agreed as a condition of securing the extension that it would supply enough cars to provide seats for all passengers during non-rush hours.

President Fred Helfinger, trustee, Frank V. Case and village attorney, W. S. Bascom, of the village of Fort Edward, came before the Public Service Commission, Second District, recently, as did also Mr. Lewis, president, and Mr. Collins, general manager of the United Gas, Electric Light and Fuel Company, which serves gas and electric light to the village.

In June, 1905, the village made a contract with the company for the lighting of the streets for the price of $80.00 per arc light. About the same time the company entered into an arrangement to light the streets of the village of Sandy Hill at $50.00 per light and the village of South Glens Falls also at $50.00. Fort Edward is about to renew its contract for the lighting of its streets, and the company now offers as its best terms $72.00 per year per light. The village authorities believe that they ought to have a lower rate for street lights inasmuch as the company will be obliged to renew its contract with Sandy Hill at a rate not to exceed $60.00, the franchise providing that no greater amount shall be paid. The village officials believe that they can secure lights at a less rate from the Hudson River Electric Power Company providing that company is allowed to come into Fort Edward. The officers of the company insist that a $72.00 rate is the very lowest that they can offer for adequate service in Fort Edward.

The commissioners pointed out that the question of what rate was being paid in Sandy Hill or South Glens Falls should have no bearing on the rate in Fort Edward, the entire question was what was a fair rate for Fort Edward, this to be determined by the cost of securing current, fixed and operating charges and a fair return upon the investment. It was finally agreed that an expert of the commission should go to Fort Edward and make a comprehensive investigation of the entire situation.

The commission has given a hearing upon the application of the Southern New York Power Company for authority to issue $40,000 in common capital stock to purchase the plant of the Walton Electric Light Company and $5,000 in capital stock to purchase the plant of the Mulkins Electric Light Company, also of Walton. Edward E. Stowell, of New York, appeared for the applicant and Albert A. Graves, president of the Southern New York Power Company, testified as to the property on which it was desired to issue capital. The applicant was instructed to submit an inventory showing the value of both plants, after which the matter will be taken up and investigated by an engineer of the commission.

LIGHTING AND POWER.

(Special Correspondence.)

THIBODAUX, LA.—This city is planning the construction of its own electric light plant. P.

ROAN, IND.—The town board has decided to install a municipal water and electric light plant. S.

MISSOURI VALLEY, IOWA.—Work has been commenced on rebuilding the electric light plant. C.

NEW HOLSTEIN, WIS.—A vote will be taken on issuing $8,000 in bonds to put in an electric light plant. P.

NEW ORLEANS, LA.—The Joachim Electric Company has been incorporated with a capital stock of $3,000. P.

WINNER, S. D.—Wm. Mullen, of Carter, is considering the establishment of an electric light plant here. P.

LEWIS, IA.—The Lewis Electric Light and Power Company has been incorporated with a capital of $5,000. P.

ANTLERS, OKLA.—The Antlers Light and Power Company has been incorporated with a capital stock of $10,000. P.

PAULINA, IA.—Fogg & Ryan have taken the contract for installing a $12,000 municipal lighting plant in this place.

PECATONICA, ILL.—Frank T. Porter, of Pecatonica, has sold the electric light plant at this place to Arthur Waterstreet. Z.

HOWARD, S. D.—The Miner County Milling and Light Company has been incorporated with a capital stock of $35,000. P.

CLEVELAND, O.—The Reserve Electric Company has been incorporated with a capital of $10,000 by W. T. Brooks and others.

MARTINEZ, CAL.—The Richmond Light and Power Company has applied for a franchise for supplying electric current in this city. A.

WALWORTH, WIS.—The Lake Geneva & Lake Delavan Electric Company has been incorporated with a capital stock of $25,000. P.

WINNER, S. D.—An electric light plant will probably be installed here in the near future. Wm. Muller of Carter will put in the plant.

GATESVILLE, TEX.—The Gatesville Light and Power Company has been incorporated with a capital stock of $15,000. J. A. Gilcreest, C. F. Caruth and J. R. Raby are the incorporators.

PORTLAND, ILL.—The city council has let the contract for the erection of a new $5,000 brick building to house the municipal lighting plant. Z.

MUNCIE, IND.—Arrangements have been made by the Muncie Electric Company to extend its lines and service to Redkey, a distance of twelve miles. S.

BLOOMINGTON, IND.—The city council has ordered that the cluster system of electric lighting be installed throughout the central portion of the city. S.

WESTPORT, CONN.—The Westport Water and Electric Light Company has now extended its lighting service and has wired a number of houses.

BERKELEY, CAL.—The Great Western Power Company has been granted a thirty-five-year frachise for distributing heat and power in the city of Berkeley. A.

JOLIET, ILL.—The Braidwood electric lighting plant has been sold to Charles O. Munroe, of the Economy Light and Power Company. The price stated is $10,000.

EAU CLAIRE, WIS.—A. E. Appleyard, who built the electric line between Chippewa Falls and Eau Claire, has begun the construction of a power plant at Ashland.

THREE FORKS, MONT.—A syndicate of Spokane capitalists will build a water power and electric light plant to cost $200,000. An initial investment of $50,000 will be made. C.

MILTON, PA.—An explosion in the engine room of the plant of the United Light and Power Company set fire to the building and destroyed it. The loss is estimated at $30,000.

BEACH, N. D.—The Beach Electric Company, capital $50,000, has been incorporated by J. G. Robertson, Alexander R. Robertson, of St. Paul, Minn., and Geo. S. Chrysler, of Beach. C.

FAIRFAX, S. D.—The Fairfax Eectric Light and Milling Company recently changed hands and the new company expects to furnish lights for Bonesteel and Herreid, S. D., and Butte, Neb. C.

McPHERSON, KAN.—Architects Kelso, Mann & Kelso of Wichita are preparing the plans for a new electric light plant to replace the one which recently burned. The new plant will cost $20,000.

DUNMORE, PA.—The Pennsylvania Coal Company is erecting a new power house on North Apple Street. They expect to do away with all their mules and equip the colleries with electric motors.

DULUTH, MINN.—The Minnesota Canal and Power Company has secured a permit to develop the water power of the St. Louis River. When completed the project will furnish about 75,000 horsepower. C.

BEAVER DAM, WIS.—The Beaver Dam Light and Power Company is extending its lines to the new plant of the Beaver Foundry Company. Many of the small plants of the city are already using electric power.

WEST BOYLSTON, MASS.—This city is now lighted by electricity for the first time. Current is taken from the 2,300-volt lines of the Connecticut River Transmission Company. Sixty-watt tungsten lamps are used.

PORTLAND, ORE.—The Pacific Power and Light Company of Augusta, Me., has been incorporated to do business in the state of Oregon with a capital stock of $7,500,000. Portland will be the principal place of business. A.

CLARION, IOWA.—This city at a special election voted to sell the electric light plant to W. H. Carr for $8,500. The franchise, which is not exclusive, grants Mr. Carr the right to operate the plant for a term of twenty-five years.

MEXICO CITY.—The capital of the Balsas Power and Irrigation Company, amounting to $200,000, has been raised and the exploiting of the concession which Lic Alfaro secured from the government will commence this year. A.

FALLS CITY, ORE.—W. E. Newson, of the Falls City Electric Company, is preparing to construct a new power house for electric lighting purposes. The new plant will be situated about 200 yards below the plant now in operation. A.

ABINGDON, ILL.—The directors of the Abingdon Electric Light Company have voted to install a new 150-horsepower boiler giving a total of 300-horsepower boiler capacity. Strawther Given has been elected manager of the company. Z.

COLUMBUS, OHIO.—Plans are being prepared for a new power house for the Mt. Vernon Railway and Light Company. Construction will begin soon on a plant having 800-kilowatt capacity. The old power house will be torn down.

OROVILLE, CAL.—John A. Hall of Plumas County and Geo. H. Sparks of this city have appropriated 2,000 inches of the water of Coldwater Creek below Buck's Ranch in Plumas County and will soon begin the erection of a power house. A.

HUDSON, WIS.—B. W. Utman, Hudson, and others have let the contract to Robt. Lang, Eau Claire, Wis., for the construction of a water power electric transmission plant at Clifton Hollow, to transmit power to Prescott, Wis., and Hastings, Minn. C.

SAN FRANCISCO, CAL.—The Merchants' Light, Heat and Power Company has been incorporated by M. D. Levenson, B. A. Goldsmith, W. Lilienthal, V. E. Mathews, A. J. Donovan, S. L. Yehl and J. Greenbaum, with a capital stock of $1,500,000. A.

ASHLAND, WIS.—A. E. Appleyard, of Boston, has purchased a tract of land including the Mellen rapids on Sand River, three miles from Copper Falls, and will put in a power plant to supply power to Ashland and other towns along Chequamegon bay. C.

PORTLAND, ME.—The Hydraulic Engineering Company has been organized for the purpose of constructing and equipping electrical plants. The capital of the company is $500,000. Officers are: President, A. F. Dunham, and treasurer, M. S. Wells, both of Portland.

CAMBRIDGE CITY, IND.—By an affirmative vote of the people the town board has been authorized to issue bonds for the purchase of additional equipment of the municipal electric light plant. The plant will also be enlarged and the lines and service extended to neighboring towns. S.

RALEIGH, N. C.—The construction work on the new engineering and electrical building of the Agricultural and Mechanical College in West Raleigh is being rapidly pushed, although the building will not be ready for the fall opening of the school. The structure will be three stories, pressed brick, with cement floors.

NEOGA, ILL.—Representatives of the Mattoon Light, Heat and Power Company seek to supply Neoga with light and power from the plant at Mattoon. President Sampsell, of the Mattoon company, is said to be planning to invade several other towns and to enlarge the central station. Z.

EL PASO, TEX.—The Sierra Consolidated Mines Company has ordered machinery for an electrical power plant at Durazno, to furnish power to its mines and mills at Ocampo. The electricity will be generated by steam power, the company owning 100,000 acres of timber land from which to get wood for fuel.

BALLS FERRY, CAL.—The $2,500 ferry boat built by the Northern California Power Company to transport heavy electrical machinery across the Sacramento River has been completed. The machinery is to be hauled from Anderson to the new power house at Coleman, four miles up Battle Creek from this place. A.

DAVENPORT, IOWA.—A plan has been submitted for the lighting of the city streets. The business section is to be lighted by five tungsten lights of 200 candlepower each. A plan under consideration calls for eighty candlepower tungsten lights at each street intersection in the residence district (107 in number).

MERRILL, WIS.—The Bradley interests have quietly proceeded with work on a new dam across the Wisconsin River during the low water, and it is nearly completed. The plant will develop 2,000 horsepower and the site is near Tomahawk. It is believed that the power is to be developed for a new manufacturing plant.

LOS ANGELES, CAL.—The Pacific Electric Company has, for $150,000, purchased a lot at Long Beach and will construct a six-story steel and concrete station and office building. This building is to be built in mission style and will embody some features of Spanish architecture. The upper floors will be used for offices.

JACKSON, CAL.—Several men representing an Eastern syndicate interested in the new power plant to be constructed on the Mokelumne River have been in this vicinity for the purpose of locating a power site. W. H. Underwood, head of the General Electric Power Company, is one of the men interested in the project. A.

WHEELING, W. VA.—The fifty-year franchise for the Wheeling Electrical Company, which has been pending in council for the past several months, has been approved by the ordinance committee. The franchise provides for the construction of a plant to cost at least $500,000 and for the privilege of using the city streets and alleys.

ROCKVILLE, IND.—The town board has decided to install new arc street lamps all over town and the direct-current system will be changed to alternating. At present the street lamps are direct and the business houses and residences are alternating. The direct current system will be disposed of. The new arc lamps will be of the latest pattern.

RICHMOND, IND.—The city council is taking steps toward the creation of a sinking fund to pay off the indebtedness of the municipal electric light plant. The bonds sold to establish the plant will be due in 1927 and the amount to be paid at that time is $144,000. It will require the average accumulation of $22 a day to be ready to liquidate the debt when due. S.

BEND, ORE.—The power dam in the Deschutes at Bend, which has been under construction for the past year, is now completed, and work is progressing on an electric light plant for the city. The machinery for this has arrived, having been freighted in by wagon from Shaniko, a distance of ninety miles. Poles are being set through the city and wires stretched.

SAN MARCOS, TEX.—On account of the failure of the San Marcos Electric Light Company and this city to make an agreement for the renewal of the company's franchise, the light company has signified its intention of withdrawing from this place. Word is now awaited from the Eastern owners by the company's management. The company's lighting franchise expired over a year ago. D.

FLATONIA, TEX.—A number of the members of the faculty of the Agricultural and Mechanical College have organized to put in an electric light and ice plant. T. M. Spinks, who has been assistant professor of mechanical engineering at the Agricultural and Mechanical College of Mississippi, at Starksville, has resigned his position and is to come to Texas to take charge of the property.

SAN FRANCISCO.—The Sierra and San Francisco Power Company has reclassified its bonds. When the company was first organized it authorized a bonded indebtedness of $20,000,000. First mortgage bonds were authorized to the amount of $14,000,000 and second mortgage bonds in the sum of $6,000,000. The rearrangement places the first mortgage bonds at $10,500,000 and the second mortgage securities at $9,500,000. The total remains as before at $20,000,000. A.

ANACORTES, WASH.—The Anacortes Water and Electric Company has just received a 400-kilowatt Curtiss steam turbine, which will increase the electric plant's capacity six times. The company will institute a twenty-four hour service, so as to accommodate the many manufacturing and other industries which use power during the day. With the new switchboards and other apparatus connected with the new machinery the additions to the present plant will cost $16,000.

ROSWELL, NEW MEX.—The Roswell Gas Company and the Roswell Electric Company have been consolidated by Otis and Hough under the name of the Roswell Gas and Electric Company. The officers of the new company are as follows: President, L. K. McGaffney, Roswell; secretary and treasurer, George W. York, Cleveland, Ohio; general manager, D. W. Low. W. D. Sweet will be retained as resident manager of the plant. The new company has other interests at Lansing, Mich., and Alliance, Ohio.

COLUMBUS, O.—The Mt. Vernon Railway and Light Company has closed a contract with the Westinghouse Electric and Manufacturing Company for the equipment of a new power house, and construction will begin in a short time. The plans call for an entirely new brick and concrete power house and all of the equipment to be installed will be new, as the old power house will be wrecked. The initial insallation will be 800 kilowatts, but the power house is planned with a view to an ultimate capacity of 2,500 kilowatts.

WENATCHEE, WASH.—As a preliminary to consolidation the Wenatchee Electric Company and the Entiat Light and Power Company have purchased the Valley Power Company interests. The property of the new merger of the three companies approximates $1,000,000, with a paid-up capital stock of $600,000. Arthur Gunn is president and manager of the new company, with J. H. Stout, secretary, treasurer and assistant manager. With the three plants about 6,000 horsepower has been developed and only about 1,000 horsepower is actually in use.

ASTORIA, ORE.—The directors of the Astoria Electric Company have completed the transfer of the company's street car line, electric light plant and gas works and all its other local holdings, including the franchises granted by the city to the Pacific Power and Light Company. The name of the local company is changed, and the business here, as well as at all the other plants which the new company owns, will be carried on under the name of the Pacific Power and Light Company, the president of which is Guy Talbot, of Portland. G. F. Nevin, also of Portland, is secretary.

OGDEN, U.—The Weber and Davis County Canal Company has started a preliminary survey of its great canal and adjoining ground for the purpose of determining upon a site for a power plant. Engineer M. Strauss, of Chicago, who supervised the electrifying of the Bamberger road, is making the survey, and from the data now at hand it is said that for $300,000 a plant sufficient to meet all purposes held in view by the canal company can be erected. Inasmuch as the surveys and investigations for sites entail an expenditure of $10,000, it is thought that the building of the plant is assured.

MOLINE, ILL.—Preparations are being made for the formal transfer of the United Light and Power Company of East Moline to the Peoples' Power Company of Rock Island and Moline. President J. F. Porter, of the Tri-City Railway and Light Company, says among the first improvements to be made after the transfer is made will be the building of a new line to supply electricity to the Union Malleable Company, the new Marseilles plant and other East Moline industries. This improvement will cost $15,000. The installation of a 12,000-horsepower unit in the Moline power plant, it is reported, will be necessary this fall. Z.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DE KALB, ILL.—The electric interurban line between De Kalb and Aurora has been put in operation with a car each hour-and-a-half.

LEE CENTER, ILL.—Two boilers of 150 horsepower each have arrived here for the power house of the Northern Illinois Traction Company. Z.

STEUBENVILLE, O.—The Steubenville & East Liverpool Traction Company has begun the erection of a $12,000 power station west of Yellow Creek.

ESCANABA, MICH.—Steps are being taken to continue the Escanaba and Gladstone interurban line from Gladstone to Rapid River, touching Kipling and Masonville. A survey will be made at once by Engineer D. A. Brotherton.

FREMONT, O.—In order to grant a franchise to the promoters of the proposed Fremont-Fostoria electric line, the residents of Burgoon, eight miles south of Fremont, asked for and were granted permission by the county commissioners to incorporate.

LOS ANGELES, CAL.—The city council is offering for sale an electric street railway franchise along Evergreen Avenue from Brooklyn Avenue to Blanchard Street, and thence along Blanchard Street to the easterly boundary of the city.

HOUSTON, TEXAS.—A trainload of fifteen electric street-railway cars, costing $75,000, has arrived here for the Houston Electric Company. The cars are of the "pay-as-you-enter" type, with all modern facilities. The local electric company has ordered forty new cars during the year. D.

JERSEYVILLE, ILL.—Because of a bonus offered by the citizens of Fieldon the Alton, Jacksonville & Peoria Railway will run its line from here to that village. The grading contract for the line from Godfrey to Jerseyville has been let to Mulville Brothers, of Alton, who are to complete the work within ninety days. Z.

CANEY, KAN.—The state charter board granted a charter recently to the Caney Light and Railway Company, with a capital stock of $10,000. This company is given authority to build an electric light plant and electric railways. The incorporators are Charles Owen, G. W. Connelly, W. H. Edgett, J. M. Ayers and B. S. Ayers.

BLUFFTON, IND.—Engineers are surveying the site and locating a new union passenger station to be built by the Marion, Bluffton and Eastern and the Bluffton, Geneva and Celina traction companies in this city. The new interurban station will be modern in every respect and with sufficient capacity for present and future needs. S.

SPRINGFIELD, ILL.—Officials of the Illinois Traction System announce that the six-mile belt line around this city will be completed by December 1 and freight service will be handled by that route after December 5 at the latest. The improvement when complete will cost $400,000. The belt line around the city of Decatur will be finished October 15.

DECATUR, ILL.—Engineer R. McCalman, of the Decatur Southern Traction Company, will soon begin surveying a route from Pana to Greenville for an extension of the proposed Decatur Southern line to St. Louis. A special meeting of the stockholders will take place August 31 for the purpose of increasing the capital stock and furthering a bond issue. Z.

STERLING, ILL.—The contract has been let for building the electric railroad from Sterling to Moline. The Northwestern Construction Company, of Milwaukee, is to do the work for $1,500,000. The directors elected include: President, W. E. Tuller, vice president, C. A. Sturtevant; secretary, Joseph Wright; treasurer, C. E. Windom; general manager, A. G. Van Petten.

HOUSTON, TEXAS.—It is stated that the power plant of the Galveston-Houston Interurban Railway, which is to be erected near League City, will be started at an early date. All the details of the plans have been completed and the material for its construction is at the site. An artesian well has been drilled at the site of the plant, which has a capacity of 250,000 gallons per day. D.

GOSHEN, IND.—The Winona Interurban Railway Company and the Indiana Union Traction Company have established through service without change of cars between this city and Indianapolis. At Peru connection is made with the Ft. Wayne and Wabash Valley Traction line, thus enabling passengers to go east or west without going north to South Bend or south to Indianapolis. S.

CHARLOTTE, N. C.—The charter for the Charlotte Rapid Transit Company, operating under the Paul Chatham franchise, has been issued by the secretary of state and received here for record. The company will begin business with $25,000 paid in and $100,000 authorized capitalization. The incorporators are Paul Chatham, Charlotte; H. C. Chatham, Elkin, N. C.; J. A. Kavanaugh, Mobile, Ala. L.

ROCHESTER, N. Y.—The North East Electric Company of Rochester has filed notice of a classification of its capital stock with the Secretary of State. According to the certificate, $100,000 is to be classified as common stock and will consist of 1,000 shares at $100 each. The preferred stock of the company will amount to $25,000 and will consist of 250 shares at $100 each. The preferred stock

is entitled to non-cumulative annual dividends at seven per cent per year out of the net earnings. T.

EAST PEORIA, ILL.—Arthur G. Black, said to represent Peoria financiers, is securing right of way for a proposed interurban line from Lacon to East Peoria. Germantown and Spring Bay, grain centers without railroads, would be touched. Franchise rights in East Peoria are easily obtained and the expense of bridging the Illinois River would be avoided, it is asserted. Black is interested in the Peoria & Galesburg Interurban Railway, but the new line is declared to be independent of any system. Z.

FT. WAYNE, IND.—At a meeting of the committee from the Central Traffic Association of electric lines in the middle states held in this city August 9, plans for the publication of a complete guide to all the interurban lines were formulated. The guides, when published, will give the schedules of every line in the Central Traffic Agreement with all connections. The members of the committee present at the meeting were: R. J. Thompson, Frank D. Norvell, W. S. Whitney, J. H. Crall and C. C. Crall. S.

ALTON, ILL.—The officers of the Alton, Peoria & Jacksonville Railway Company have signed and delivered to the Alton Banking and Trust Company a mortgage for $600,000 to secure a bond issue for that amount to build the electric line from Alton to Jerseyville. But $450,000 will be used for the extension of the line which is now in operation between Alton and Godfrey and the remainder will be held in trust. Plans call for the road passing through Newburn, Dow and McClusky. The power house will be located on Piasa Creek. Z.

PHILADELPHIA, PA.—A mortgage for $4,000,000 has been given on the lines of the Western Railway Company to the Philadelphia Trust, Safe Deposit and Insurance Company. At the same time an old mortgage for $20,000,000 was cancelled. The new mortgage covers all of the property of the company, including road, equipment, power houses, right of way and the extension to be built to Norristown. The proceeds of the sale of the bonds will be used to build an extension of the Philadelphia and Western from its present line to Norristown, from which place it will be continued to Lansdale or North Wales, where connections will be made with the line of the Lehigh Valley Transit Company, which runs through Bethlehem and Allentown.

CHARLOTTE, N. C.—The Piedmont Traction Company, the North Carolina end of the proposed 250-mile interurban electric system backed by the Southern Power Company and the Duke interests, has formally applied for a charter to build its tracks over the streets of this city, and the board of aldermen has referred the franchise matter to a committee of five The Charlotte Power Company, backed by the same interests, is also seeking a franchise for local use, selling electric power and supplying the electricity and gas for lighting purposes. This last now operates under the Southern Power Company's charter as a branch of the business. The Charlotte aldermen have, as previously announced, also granted a franchise to Paul Chatham and associates to build a local electric line. L.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

TEXARKANA, ARK.—The Texarkana Telephone Company will expend some $10,000 for improvements. P.

CHIPPEWA FALLS, WIS.—A new switchboard to cost $10,000 will be installed in the telephone office. C.

WATERTOWN, S. D.—The Dakota Central Telephone Company will expend about $20,000 on improvements. P.

BRADY, TEX.—J. N. Paxton, of Abilene, Tex., has purchased and will improve the local telephone system. P.

SAN MARCOS, TEX.—G. G. Johnson and others have purchased and will improve the San Marcos Telephone Company. P.

WENATCHEE, WASH.—The Farmers' Telephone Company is erecting a modern brick exchange building on Chelan avenue. C.

HARRISBURG, N. C.—The Harrisburg Telephone Company is reported incorporated by S. A. Grier and associates. The capital is $10,000. L.

BEAVERVILLE, ILL.—The Beaver Telephone Company has been organized with a capital of $2,000 by E. C. Regnier, Charles Forten and Sovreign Franconer.

STROUD, N. D.—The Dakota Western Telephone Company will construct thirty-seven miles of two-wire circuit to Alexander. Twenty-foot cedar poles will be used. C.

JANESVILLE, WIS.—Plans are being made for the rearrangement of the telephone system and the construction of a new exchange. The improvements will cost about $75,000.

SANDSTONE, MINN.—The Sandstone Telephone Company has incorporated under the title of the Eastern Minnesota Telephone Company, and will extend its lines to Superior and Duluth. C.

ALBION, N. Y.—The Albion Home Telephone Company, including the lines in several towns of Orleans County, has been sold at public auction. J. P. McDonough, of Newark, bought the property.

WOODLAND, N. C.—The Roanoke-Thowan Telephone Company is chartered in North Carolina, capital $50,000 and headquarters at Woodland. D. L. Minton and several others are the incorporators. L.

VIRGINIA, MINN.—Bids will be received up to 8 p. m. September 5 by Albert E. Bickford, secretary of the police and fire commission, for furnishing the fire department with ten alarm boxes.

LAS CRUCES, N. M.—The Tri-State Telephone Company, which has taken over the local telephone exchange, will soon begin the erection of a new plant and new system through this city.

VANCOUVER, B. C.—The Pacific Telephone and Telegraph Company has been granted a franchise to lay an underground conduit for a trunk line for the new subway system of telephone lines. A.

COLERIDGE, N. C.—The Coleridge Telephone Company has received a charter from the secretary of state authorizing a capital of $10,000. D. H. Lambert and others are represented among the stockholders. L.

WEST LOVELL, ME.—The West Oxford Telephone Company has been organized with a capital of $5,000 to conduct a telephone business. The officers are as follows: President, William H. Smith; treasurer, Mandall A. LeBaron.

PIQUA, OHIO.—The Home Telephone Company and the Greenville Bell Company in this city have combined. All local work will be handled by the Home boards, and the long distance lines will be cared for from the Bell offices. H.

SAN FRANCISCO, CAL.—The Santa Fe has ordered apparatus to equip 460 miles of its line with telephone for dispatching trains. The outside construction work is already under way. At present 2,275 miles of the line are so equipped.

LEWISTON, IDA.—The Clearwater Telephone and Telegraph Company has been incorporated by Samson Snyder, A. Anderson, F. Jones, J. Decourtsey and J. Failley, with a capital stock of $40,000. The proposed length of the company's line is 200 miles.

BINGHAMTON, N. Y.—After a long controversy the city council has given permission to the telephone company for the use of its conduits. The company desired to build three manholes and three laterals, to which the council, through a misunderstanding, objected.

LITTLE ROCK, ARK.—The Arkansas and Texas Telegraph and Telephone Company of Texarkana was chartered by the state. The capital stock is $25,000, of which amount $3,000 is subscribed. The incorporators are A. C. Stewart, president; J. E. Ritchie, C. M. Conway.

MAUCKPORT, IND.—The Eureka Telephone Company has given notice to the Secretary of State of an increase of capital stock from $25,000 to $50,000. The company will soon be in the market for material and equipment for the general improvement and extension of the system. Edward P. Windell is president. S.

DANVILLE, VA.—An important telephone line will soon be connected with the Southern Bell Telephone Company in Danville. The line will be constructed by Travis and Harvey, who have signed a contract to connect with the Southern Bell Company. The new line will extend twelve miles from Danville, in the direction of Yanceyville and Pelham, N. C.

READING, PA.—The new telegraph and telephone company organized in Berks County is to be known as the Berks and Lehigh Company. The company will be capitalized at $10,000. Its incorporators are William Y. Fetherolf, Jesse M. Lengel, Elmer J. Bachman, Edgar Greenawald and James Focht, all residing in the upper section of the county and in Lehigh. James S. Focht is secretary and treasurer.

SPENCER, N. C.—The Southern Bell Telephone Company recently presented to the board of aldermen of this city a plan for rehabilitating and rebuilding the Spencer plant, and the board, after consideration, has decided to permit the carrying out of the proposed plans, calling for the rebuilding of the local telephone plant and also of the lines from Spencer to Salisbury. The work contemplated will call for $12,000 to $15,000. L.

LAS ANIMAS, COLO.—The Colorado Telephone Company will make $50,000 worth of improvements in the Arkansas Valley this year. In addition to $22,000 that will be spent in improving the plants at Las Animas, Lamar and Holly the company will expend $12,000 at Rocky Ford, $12,000 at La Junta and $4,000 at Mazanola and Fowler. These amounts will be used in placing the offices and cable plants in these towns in first-class condition.

ENID, OKLA.—The Pioneer Telephone and Telegraph Company has decided upon extensive improvements to its local and long distance equipment in this city. An expenditure of $150,000 is planned. More than 1,200 more telephones will be installed. These extensive improvements will swell the investment of the Pioneer company in this city from $265,000 to $400,000. Besides giving every local subscriber connections with 1,200 more local phonse, they can talk to 1,000 rural residents.

SEATTLE, WASH.—C. H. Gaunt, general superintendent of the Pacific Division of the Western Union Telegraph Company, announces that his company will build a new telegraph line from Seattle to Helena, Mont. Material for this line is now being assembled. Mr. Gaunt has also made public the appointment of Edward Boening, formerly attached to the superintendent's office in San Francisco, to take charge of the Seattle office, succeeding District Superintendent R. T. Reid, whose resignation has been presented. A.

ELECTRICAL SECURITIES.

The stock market continued to improve last week, closing dull, but slightly higher than on the last day of the preceding week. At all times during the week the tone of the market was strong. There were no unexpected developments, an increase in investment buying was noted, the bond market improved and substantial proof that the crops are all right was seen. Seasonable dullness rules in the iron and steel markets, with prices showing a tendency to harden, and every indication of buying within the month. The money situation shows better, money for over January maturities lending freely at lower rates. Call money is easy. The total of surplus bank reserves is $56,000,000, nearly three times that of a year ago. Reports from the West and South show easier conditions, with nothing to indicate stringency later.

Chicago Commonwealth Edison July earnings exceeded all previous records for that month. Heavy demands for lighting service for Knights Templar illuminations will make August earnings break all former monthly records.

Chicago City Railway July gross earnings were $863,558, or about four and one-half per cent above May and June. August figures indicate a new record, partially on account of convention traffic. Earnings from April 16 to July 31 are $2,926,058.

DIVIDENDS.

Brooklyn Rapid Transit Company; regular quarterly dividend of one and one-fourth per cent, payable October 1 to stock of record September 9.

Elmira Water, Light and Railroad Company; regular semiannual dividend of two and one-half per cent on the preferred, payable September 1 to stock of record August 16.

Gas and Electric Securities; initial monthly dividend of seven-twelfths of one per cent.

New York & Queens Electric Light and Power Company; regular quarterly dividend of one and one-fourth per cent on the preferred stock, payable September 1 to stock of record August 26.

The American Telegraph and Cable Company has declared the regular quarterly dividend of one and one-quarter per cent, payable September 1 to stock of record August 31.

The Underground Electric Railways Company, Ltd., of London has declared an initial semi-annual dividend of one-half of one per cent on the income bonds for the half year ended June 30. This payment will be made in New York at the office of the New York Trust Company at the rate of $4.8666 per pound sterling.

The Susquehanna Railway, Light and Power Company has declared a regular semi-annual dividend of two and one-half per cent on the preferred stock, payable September 1 to stockholders of record August 15. Books close August 15, reopen September 1.

CLOSING BID PRICE FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Aug. 22	Aug. 15
Allis-Chalmers common	9	8
Allis-Chalmers preferred	33	30
Amalgamated Copper	65⅞	66½
American Tel. & Cable	*80	*80
American Tel. & Tel.	134¾	133¾
Brooklyn Rapid Transit	77	77
General Electric	144	143
Interborough-Metropolitan common	18¼	17
Interborough-Metropolitan preferred	48¾	47
Kings County Electric	121	124
Mackay Companies (Postal Telegraph and Cables) common	86¾	85
Mackay Companies (Postal Telegraph and Cables) prefd.	74	73
Manhattan Elevated	131	128
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	71½	71¼
U. S. Steel preferred	116⅝	116¾
Western Union	61	63½
Westinghouse common	60	59
Westinghouse preferred	*125	*125

*Last price quoted.

BOSTON.

	Aug. 22.	Aug. 15.
American Tel. & Tel.	134¾	133¾
Edison Elec. Illuminating	258½	256
General Electric	144	143
Massachusetts Electric common	17¼	16
Massachusetts Electric preferred	82½	81½
New England Telephone	129	129
Western Tel. & Tel. common	15	15
Western Tel. & Tel. preferred	84	84

PHILADELPHIA.

	Aug. 22.	Aug. 15.
American Railways	44	43
Electric Company of America	11⅝	11
Electric Storage Battery common	49¾	49½
Electric Storage Battery preferred	49¾	49¼
Philadelphia Electric	15	15¼
Philadelphia Rapid Transit	19¼	20
Philadelphia Traction	83¾	82⅝
Union Traction	44¾	45½

CHICAGO.

	Aug. 22.	Aug. 15.
Chicago Railways, Series 1	65	70
Chicago Railways, Series 2	16	16
Chicago Subway	5¾	5¼
Chicago Telephone	117	117
Commonwealth Edison	111	111
Metropolitan Elevated common	19	19
Metropolitan Elevated preferred	61	61
National Carbon common	119½	117½
National Carbon preferred	118	117

PERSONAL MENTION.

F. R. JARBEUA, of Indiana, has succeeded W. L. Ford, resigned, as manager of the Green County (Ill.) lines of the Central Union Telephone Company.

F. E. NEWBERRY, of Kankakee, Ill., has assumed the superintendency of the electric and gas departments of the Lee County Lighting Company at Dixon, Ill.

C. C. BOTHWELL, formerly with the *Canadian Electrical News*, has severed his connection with that journal and will open a district sales office for a Montreal electrical firm.

HENRY L. DOHERTY has resigned as president of the American Gas and Electric Company, and R. E. Breed, formerly vice-president, has been elected to succeed him. Mr. Doherty remains a director.

W. LEON PEPPERMAN, assistant to Theodore P. Shonts, president of the Interborough Rapid Transit Company, has returned to New York after a six weeks' vacation trip, which he spent in motoring through England and on the Continent.

JOSEPH O'HARE, for several years connected with the McKinley lines as superintendent of the Morris-Princeton division, has been elected general manager of the Chicago, Aurora and De Kalb Railway to succeed W. C. Cram, who resigned. Mr. O'Hare will assume his duties September 1.

H. A. STRAUSS, vice-president and chief engineer of the Falkenau Electrical Construction Company, Chicago, Ill., has been appointed consulting engineer of the Alton, Jacksonville & Peoria Railway Company, to undertake the design of the extension of this system. The proposed extension will run to Jerseyville, Ill., involving about twenty miles of roadbed, track and overhead construction.

V. F. HAMMEL, engineer in charge of the Pittsburg office of J. B. Hogg, civil and mining engineer, has recently resigned his position. Mr. Hammel will take charge of the design and construction of the public water supply and power house improvements for the Union Utilities Company, Morgantown, W. Va. The work consists of the construction of a 75,000,000-gallon storage reservoir, a concrete gravity dam and miscellaneous power house improvements.

DR. W. H. TOLMAN has been designated by the State Department as a delegate on the part of the United States to the International Congress on Workmen's Insurance, to be held at The Hague, September 6-9. Dr. Tolman is at present the director of the American Museum of Safety and chairman of the American Executive Committee of the International Committee on Social Insurance. Among the questions to be discussed at this convention is the extension of social insurance to include others than workmen. This movement includes small trades people, and contemplates making provision for widows and orphans as well as insuring against unemployment.

OBITUARY.

THEODORE P. BAILEY, assistant manager of the Philadelphia district of the General Electric Company, a pioneer worker in electric lighting in the middle west and the first man to introduce electric railways west of the Allegheny Mountains, died at his home at Mount Airy, Philadelphia, after an operation for appendicitis.

Theodore P. Bailey was born in Covington, Ky., August 17, 1856. After newspaper work at Princeton, Ill., where he had attended school, Mr. Bailey studied shorthand and became court reporter at Morris, Ill. Court work awakened a desire to become a lawyer, and he studied law at night, while reporting in Joliet. In 1881 Mr. Bailey located at Ottawa, where he was associated with James H. Eckles and was admitted to the bar. Later he removed to Chicago, where he became associated with Gen. A. K. Stiles, one of the original backers of the Van Derpoele Electric Company, and in 1883 Mr. Bailey became identified with these electrical interests. The Thomson-Houston Electric Company needed a good man in its Chicago office, and in 1885 T. P. Bailey was their western representative. When the Thomson-Houston company was merged into the General Electric Company, Mr. Bailey continued in immediate charge of its street-railway business in the Chicago district, later becoming assistant manager of that office. In 1905 he resigned his position to go into the railway contracting business as vice-president and general manager of the L. E. Myers Company, Chicago, where he remained until 1907. After nearly a year in charge of the automobile department of the St. Louis Car Company, in the fall of 1908 Mr. Bailey returned to the General Electric Company as assistant manager of the Philadelphia district, where he was engaged until his death.

For many years Mr. Bailey was the most widely known man in street-railway circles in the west. He was among the first to project electric lighting systems in the middle west and was interested in establishing the first installations in such cities as Des Moines, Omaha, Topeka, St. Louis, Kansas City, Minneapolis and St. Paul. He was a man of wide acquaintance in his chosen profession and leaves behind a host of friends to mourn his loss. He had been ill but a short time when an operation was pronounced necessary, but the best medical skill could not save him. The widow and one child survive. The funeral was held on Tuesday morning at his late home in Philadelphia.

NEW PUBLICATIONS.

THE WIRELESS BLUE BOOK for 1910 has appeared, and is an advance over last year's publication, both in appearance and in contents. It is published by Modern Electrics, New York City.

THE ELECTRIC LIGHTING OF AUTOMOBILES.—Under this title the engineering department of the National Electric Lamp Association has issued a bulletin supplying technical information on automobile illumination. Numerous head lights and side lights are illustrated and diagrams of several generator devices are included. Comparative curves of the illumination produced by acetylene and electric lights show the excellence of electricity for this work.

BULLETIN OF AMERICAN REPUBLICS.—The July and August numbers of the *Bulletin* of the International Bureau of American Republics are devoted to the annual review of the commercial and economic conditions and progress of the twenty-one republics on the North and South American continents and their tributary islands. The 390 pages in these two numbers contain a great mass of valuable information that it should be desirable for those interested particularly in the Latin American countries to possess.

A. E. G. ZEITUNG.—The August number of the Allgemeine Elektricitäts Gesellschaft *Zeitung* contains a number of articles of much interest. Among these are the concluding article on the company's turbines, a well-illustrated article describing several water-power plants, a description of the uses of electricity at a large machinery works at Stettin, Germany, a further installment in the serial by Dolivo-Dobrowolsky on the measurement of electric currents, and a description of an electrically operated machine for piling up long telephone and similar poles.

PROPOSALS.

POST OFFICE, GREENSBURG, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until September 26, for the construction, complete, (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Greensburg, Pa., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Greensburg, Pa., or at the Supervising Architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

Date of opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule Number.
August 30—	Cross arms, pins, etc.	Miscellaneous	Las Animas, Colo.	2808
	Turbo-generators and accessories, five-kilowatt.	11 sets	Various	2792
	Wire, copper, bare	10,000 feet	Las Animas, Colo.	2808

INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw Mich., recently issued their August stock list superseding all previous issues. The company makes a specialty of complete plants, either for wrecking or for sale as going concerns.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., recently issued the August issue of *Graphite*. The number contains a number of valuable points on lubrication, which are especially applicable to automobiles.

THE STEWART-HOWLAND COMPANY, Boston, Mass., has mailed a flyer illustrating the Stewart-Howland series multiple system for lighting automobiles. Any style of series or multiple lamp and any style or voltage of battery may be used. The leaflet gives a list of the prices of material needed for the lighting system. By putting in a separate circuit, headlights may also be added to the equipment.

THE ROME WIRE COMPANY, Rome, N. Y., has issued a booklet of price lists and useful information pertaining to wire, both bare and insulated for electrical purposes. The book was prepared not only to acquaint the trade with the various copper wire products, but also to give accurate and complete data for reference. Illustrations, a number of them in color, do much to show the reader the exact appearance of the company's product.

ABELES & TAUSSIG, St. Louis, Mo., dealers in cypress poles and oak ties, state that they have a large stock on hand and are in a position to fill orders of any size. Among other shipments of poles and ties was one to the Taylorville, Ill., Railway, Light, Heat and Power Company. Another shipment of six hundred cars of lumber, ties and piling was sent to the Atlantic, Northern & Southern Railway Company.

THE FEDERAL ELECTRIC COMPANY, Chicago, Ill., mentions in the August number of *The Federalist*, the lighting of the Gimbel Store in Philadelphia. In one section of this store which is shown by an illustration, the ninety-six arc lamps formerly used have been replaced by an equal number of Federal No. 756 ceiling clusters. A folder enclosed with this booklet describes and illustrates the Federal street board for outdoor tungsten lighting.

CHARLES L. KIEWERT COMPANY, New York, N. Y., recently distributed to moving-picture operators a folder of instructions on the use of "Bio" carbons. The advantage of such carbons, states the folder, lies in the fact that they are not merely adapted to moving picture machines but are designed especially for this purpose. In addition to the printed directions a diagram is given showing the setting of carbons for direct-current and for alternating-current service.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., has just distributed an attractive little booklet of envelope size on their paint for steel cars. The booklet not only goes into the merits of the Dixon paint for this service, but illustrates a number of different types of steel cars upon which Dixon's paint has given excellent service. The booklet also contains color chips showing the four colors in which Dixon's Silica-Graphite steel car paint is made.

THE CUTLER-HAMMER MAUFACTURING COMPANY, announces in a recent bulletin that it has perfected arrangements to manufacture and market the "Kohler System" automatic controlling devices. The Cutler-Hammer Company has taken over all the data and records of Kohler Brothers and have retained the services of their experts as well. The booklet in which this announcement is made is very attractively prepared and contains inserts illustrating motor equipment of various types.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., describes in a recent booklet its multiple-unit electric interlocking system. In addition to the complete description of the operation of this system numerous diagrams are given. The company is also sending out an electro-mechanical catalog for 1910. One of the features of the apparatus described therein is the combination power interlocking and mechanical interlocking. This booklet also contains a number of diagrams.

THE INVINCIBLE ELECTRIC BANK PROTECTION COMPANY, of Monroe, Wis., manufacturing electric burglar-alarm systems, steel filing cases, safe deposit boxes, steel desks, and safe cabinets, was on August 16 awarded the contract amounting to $3,269.75 for the steel desks to be installed in the assembly chamber of the new Wisconsin State Capitol Building, Madison, Wis. The company has recently opened up a branch agency in New York City, in charge of Philip Abrahams and Francis Koref, with offices at 29-31 Liberty Street.

THE KELLER MANUFACTURING COMPANY, Philadelphia, Pa., recently issued circular No. 46, suggesting sales plans for companies handling the Keller-Santo vacuum cleaners. This bulletin suggests a number of "Things to do" in August which will not only produce sales in that month, but will serve as a solid foundation for future sales. One of the points made is that the central-station companies are as anxious to get this new business as is the vacuum cleaner sales agent; hence the two interests can co-operate and gain the advantage which combined effort will bring. The bulletin contains a number of other equally valuable suggestions.

W. & L. E. GURLEY, Troy, N. Y., announce in their 1910 catalog that in connection with the manufacture of civil engineers' and surveyors' instruments they have established a department for the production of physical and scientific apparatus of all kinds. This revised and enlarged catalog is divided into sections and the finding of any piece of apparatus is greatly facilitated. The sections listing apparatus for the measurement of induction, magnetometers, inclinometers, variometers, resistance boxes, Wheatstone bridges, etc., are of especial interest. The book is nicely bound in cloth and exceedingly well illustrated.

THE KINETIC ENGINEERING COMPANY, of Philadelphia, Pa., has published an attractive sixteen-page pamphlet on modern organ blowing by means of Kinetic organ blowers. It gives a historical review of the evolution of the pipe organ from ancient times to the present, calling attention particularly to the primitive methods of organ blowing formerly in vogue. The Kinetic blowers are described and a large number of views of churches and other institutions using them are shown. These motors are electrically driven and are very quiet running. They do not heat the air and are easily installed for any type of pipe organ. Either alternating-current or direct-current motors are supplied.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has recently received an order from La Blanca and Anexas Mining Company for forty motors to be used in the company's mill at Pachuca, Mexico. The motors ordered range in size from five horsepower on the pulp thickeners to seventy-five horsepower on the tube mills. The order also includes seven 250 kilovolt transformers and one twelve-panel switchboard. The Westinghouse Company has also recently received an order from the Mexican-North Western Railroad Company. The order includes 168 induction motors, aggregating 3,736 horsepower, of the types MS and HF, ranging from three to 200 horsepower. These motors will be shipped to the company's property at Madera, Chihunhua, Mexico, to be used in the operation of its saw and planing mills.

THE YALE & TOWNE MANUFACTURING COMPANY, New York, N. Y., is distributing advance copies of its new lock and hardware catalog. This is a loose leaf catalog, as is also its accompanying price book. The book contains upward of 900 pages, the bulk of the edition being on the finest coated paper with more than 4,000 new illustrations made especially for this work. A most noticeable feature of the book typographically is the omission

of all rules, both vertical and horizontal. By a careful arrangement of type the important matters are emphasized as clearly as by the old method of separating them by vertical and horizontal rules. Monotype composition was used throughout. The extensive line of Yale door-closing devices, embracing not only the well-known Blount door check, but a variation of this which permits the door to be held open at will (also a double-acting check and checking floor hinge(are very fully illustrated and described. The company's line of miscellaneous hardware is alphabetically arranged, and is illustrated largely by half-tone pictures produced from photographs. An important improvement in the illustrations consists in showing various types of locks and miscellaneous hardware as in use. This applies not only to such items as locks and latches (which are shown mounted on a sample board prepared like an actual door), door checks, etc., but also to casement adjusters.

DATES AHEAD.

Telephone and Telegraph Engineers' Second International Conference. Paris, France, September 4-11.

International Association of Municipal Electricians. Annual convention, Rochester, N. Y., September 6-9.

Associations of Edison Illuminating Companies. Annual convention, Frontenac, N. Y., September 6-9.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Twenty-ninth annual reunion, Chicago, Ill., September 8-10.

New England Section, National Electric Light Association. Fall convention, Pleasant Point, New London, Conn., September 13 and 14.

International Congress of Radiology and Electricity. Brussels, Belgium, September 13, 14, 15.

Pennsylvania Electric Association. Convention, Glen Summit Springs, Pa., September 14-16.

National Association of Cotton Manufacturers. Semi-annual meeting, Portsmouth, N. H., September 15, 16, 17.

Pacific Coast Electrical Exposition. San Francisco, Cal., September 17-24.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Colo., September 21, 22 and 23.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27 and 28.

Vermont Electrical Association. Annual meeting, Brandon, Vt., September 28 and 29.

Denver Electric Show. Colorado Electric Club, Denver, Colo., October 8-15.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

Railway Signal Association. Annual meeting, Richmond, Va., October 12-15.

American Electrochemical Society. Eighteenth general meeting, Chicago, Ill., October 13-15.

American Iron and Steel Institute. First meeting, New York City, October 14 and 15.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

Alabama Light and Traction Association. Next meeting, Anniston, Ala., November 21-23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 16, 1910.

967,151. INDICATOR FOR ARC-LAMPS. Joseph H. Allen, Chicago, Ill., assignor to General Electric Company. Filed Jan. 23, 1908. A normally concealed signal is exposed to view when a trigger is tripped by the carbon holder.

967,159. METHOD OF REDUCING ORES. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. Filed March 24, 1908. The method of reducing ores consists in passing through a molten bath containing a compound of a metal and a reducing agent an electric current carried by a metallic electrode depending into the bath, and cooling the electrode to protect it from the bath and reduction products.

967,171. LOW-SPEED CIRCUIT-CONTROLLER. Fred B. Corey, Schenectady, N. Y., assignor to General Electric Company. Filed May 20, 1909. A low-speed circuit-controller comprises a worm, a worm-wheel adapted to be driven in either direction by the worm, means acting directly on the worm to limit the range of movement of the wheel and adjustable to vary the range, and two sets of contacts arranged to be closed respectively when the wheel reaches the two limits of its range of movement.

967,186. CONTROL SYSTEM FOR ELECTROMAGNETS. Jay H. Hall, Cleveland, Ohio, assignor to The Electric Controller and Manufacturing Company, Cleveland, Ohio. Filed May 13, 1910. These are connections constructed and arranged to cause energizing currents to flow successively through the winding in opposite directions and to interrupt the second energizing current when it reaches a predetermined value.

967,190. SWITCH FOR ELECTRIC TOOLS. Louis A. Hauck, Cincinnati, Ohio. Filed Jan. 27, 1909. An electric switch for portable electric tools comprises terminals and a movable contact piece for making and breaking the circuit between the terminals (the terminals and contact piece being mounted in a protected position on the body of the tool), a thumb-piece capable of reciprocation, and spring-pressed means adapted to carry the thumb-piece from an intermediate position to one or the other of its extreme positions (the thumb-piece and spring-pressed means being mounted upon the handle of the portable tool), and means for connecting the thumb-piece and the contact piece.

967,192. RELAY FOR BLOCK-SIGNAL SYSTEMS. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 19, 1906. Renewed March 4, 1908. There is a movable contact member having operative positions on both sides of its off-position and means operative upon the de-energizing of the relay for locking this member in off-position, means are provided for unlocking the member automatically when the relay is energized.

967,200. ELECTROLYTE AND METHOD OF ELECTRO-DEPOSITING ZINC. Edward F. Kern, Knoxville, Tenn., assignor of one-half to Percy S. Brown, New York, N. Y. Filed Sept. 1, 1909. A process of electro-depositing zinc consists in electrolyzing a solution containing fluosilicate of zinc, fluosilicate of a metal which stands higher in the solution pressure series than zinc, an organic addition agent and ammonium fluoride.

967,204. MAGNETO-TELEPHONE. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Co., Genoa, Ill. Filed June 19, 1908. A wall telephone is described.

967,210. ELECTRIC-MOTOR CONTROL. Lloyd V. Lewis, Wilkinsburg, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa. Filed April 9, 1910. A transformer is connected to the motor windings, the direction of rotation of the motor being controlled by controlling the direction of flow of current through the transformer.

967,217. TRANSMITTER. Hans S. Mattison, La Crosse, Wis., assignor to Vote Berger Company, La Crosse, Wis. Filed March 22, 1909. The diaphragm has in its face a peripheral groove, and a resilient gasket lies partly within this groove and between the diaphragm and the faceplate of the transmitter case.

967,222. RELAY. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa. Filed March 5, 1910. A relay comprises a vane capable of assuming three control positions, a magnetic field and a winding therefor, tending to move the vane in one direction when energized by alternating current; a second magnetic field and two oppositely connected windings therefor, the second field tending to limit the movement of the vane to one of its control positions when one of its coils is energized by alternating current, and permitting the movement of the vane under the influence of the first magnetic field to another of its control positions when both of the oppositely connected coils are energized by alternating current.

967,233. ELECTRIC INCANDESCENT LAMP AND CONNECTIONS THEREFOR. William J. Phelps, Detroit, Mich.; J. Wiley Phelps, administrator of said William J. Phelps, deceased, assignor to William C. Harris, Detroit, Mich. Filed July 15, 1907. At the end of a flexible conductor cord is a three-position switch for connecting up the lamp to the circuit independently or in circuit with a resistance.

967,234. FLUID-PRESSURE REGULATOR. Thomas S. Pukerud, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Oct. 3, 1906. Includes a motor-driven pump, etc.

967,237. ELECTRIC HOIST. August Rausch, Berlin, Germany, assignor to General Electric Company. Filed March 2, 1910. A controller permits the motor to act as a braking generator during the descent of the cage or for automatic stopping.

967,240. COIL-SUPPORTING STRUCTURE FOR DYNAMO-ELECTRIC MACHINES. Joseph T. Roberts, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed Nov. 6, 1908. An armature winding comprising a plurality of coils has coil ends which extend beyond the core member; a movable member is adapted to rotate within the core member; brackets are secured to the stationary frame, and baffle plates supported by the brackets form a chamber adjacent to the end of the machine.

967,245. ELECTRICALLY-OPERATED CONTROL MECHANISM FOR PNEUMATIC OPERATING DEVICES. Harold Rowntree, Chicago, Ill., assignor to National Pneumatic Company. Filed April 2, 1908. An electrically controlled door-operating mechanism.

967,254. TURBO-GENERATOR CONSTRUCTION. Charles H. Smoot, Chicago, Ill., assignor to General Electric Company. Filed Jan. 2, 1906. A rotor for a dynamo-electric machine comprises a cylindrical core having a group of insulated conductors extending longitudinally of the core in a radial slot therein, end disks for interconnecting the conductors, the radially innermost conductors being connected to the outermost disks respectively, and the disks being each provided with a slot corresponding in size to the conductor or conductors passing through the same.

967,276. MICROTELEPHONE. John N. Wallace, La Crosse, Wis., assignor to Vote-Berger Company, La Crosse, Wis. Filed March 22, 1909. A microtelephone comprises a handle member, a receiver and a transmitter, the handle member being composed of two half-tubular members and two binding members adapted to hold the half-tubular handle members together.

967,280. MAGNETIC BLOW-OUT. Harold E. White, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 4, 1910. A blowout magnet has two coils, one normally in circuit and the other normally inactive but provided with terminal members against which an arc between separable contacts is blown by the field produced by the first coil. Plates having adjacent edges near the contacts curve away in the direction in which the arc is blown, whereby an arc springing from the contacts to said members places the second coil in series with itself and is blown along the plates by the combined fields of both coils.

967,281. MAGNETIC BLOW-OUT. Harold E. White, Schenectady, N. Y., assignor to General Electric Company. Filed February 4, 1910. Similar to the preceding.

967,283. SPARKING PLUG. Knut C. Wideen, New York, N. Y., assignor to Arc Spark Manufacturing Company, New York, N. Y. Filed January 25, 1906. Describes a chambered-plug type of spark plug in detail.

967,295. BRAKING ALTERNATING-CURRENT MOTORS. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed June 4, 1906. The method of braking an alternating-current motor of the commutator type consists in connecting the armature to the source, and connecting the field in shunt to the armature through a phase-shifting device adapted to shift the phase of the voltage impressed on the field substantially ninety degrees from the voltage of the source, and controlling the phase of the voltage impressed on the field to vary the braking effect.

967,296. ELECTRIC BRAKING. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed February 19, 1908. The method of braking electrically in systems employing a plurality of motors of the commutator type adapted to drive a common load, consists in operating a portion of the motors as generators driven by the load and excited from the source of current supply, and operating other of the motors as generators driven by the load to return power to the source, the latter portion of the motors being excited differentially by the current generated in the first-mentioned motors and by the current returned to the source.

967,323. CLUTCH ARRANGEMENT FOR ARC-LAMPS. Tito Livio Carbone, Berlin, Germany, assignor to The Firm of Carbone-Licht-Gesellschaft M. B. H., Berlin, Germany. Filed March 5, 1907. An electric-arc-lamp clutch comprises a vertically oscillating rod, a pair of plates loosely pivoted by one end to the lower part of the rod, the end of the plates farthest from the rod being provided with holes for the passage of the light-giving carbon, the hole in the upper plate being somewhat larger than that in the lower, the two plates when raised holding the carbon by two inner edges of the lower plate and one inner edge of the upper plate.

967,325. WIND-WHEEL ELECTRIC GENERATOR. Alfred Carlson, Klamath Falls, Ore. Filed August 9, 1909. The mill drives the generator directly through a worm gear.

967,344. SPARKING IGNITER. George F. Dillig, Baltimore, Md. Filed April 6, 1908. Includes a rocking electrode and means for operating it.

967,360. INSULATION-BAG FOR CONDUITS. Anton Funke, Westig, Germany, assignor to The Papyrus Artificial Paper Manufacturing Company, Hoboken, N. J. Filed July 16, 1909. A bag for the insulation of conduits consists of a piece of fibrous material which is provided with successive cross crinkles or folds and the edges of which are secured together to form a tube.

967,361. ALTERNATING-CURRENT MOTOR. Valère Alfred Fynn, London, England. Filed January 29, 1909. In combination with an inducing member provided with a main inducing winding, is an induced member provided with a commuted winding and a winding permanently closed on itself, a neutralizing winding on the inducing member being connected with the commuted winding that the current passing through one will bear a constant ratio to the current passing through the other. Means are also provided for varying the ampere turns of the neutralizing winding.

967,362. ALTERNATING-CURRENT MOTOR. Valère Alfred Fynn, London, England. Filed May 8, 1909. Similar to the preceding.

967,363. ALTERNATING-CURRENT MOTOR. Valère Alfred Fynn, London, England. Filed July 9, 1909. Similar to No. 967,361.

967,386. SYSTEM OF CONTROL FOR ALTERNATING-DIRECT-CURRENT MOTORS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 18, 1905. There are translating devices and means for adjusting the circuit relations thereof in accordance with the character of energy that may be supplied thereto, and means for preventing a supply of energy to the translating devices until the circuit connections thereof correspond to the character of the energy to be supplied thereto.

967,387. SYSTEM OF CONTROL FOR ALTERNATING-DIRECT-CURRENT MOTORS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 18, 1905. Similar to the preceding.

967,388. ELECTRICAL CUT-OUT DEVICE. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed March 3, 1906. In combination with stationary terminal pieces, are fuse-holding terminal pieces, a fuse mounted in the fuse-holding terminal pieces, and an insulating box or casing the bottom of which is open and the sides of which support the fuse-holding terminal pieces.

967,389. ALTERNATING-DIRECT-CURRENT SYSTEM OF CONTROL. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 18, 1905. Renewed March 15, 1909. Similar to No. 967,386.

967,398. MECHANICAL CONTROLLER FOR ELECTRIC CURRENTS. David L. Lindquist and David Larson, Yonkers, N. Y., assignors to Otis Elevator Company, Jersey City, N. J. Filed October 30, 1907. In combination with one or more electric switches, are cams for actuating the switches, a shaft to rotate with the cams, connections for actuating the shaft, an additional cam connected to rotate with the shaft, a cam sleeve loose on the shaft, one or more additional switches and one or more cams carried by the sleeve for actuating the switches, and automatic means normally held inoperative by the additional cam rotating with the shaft, for rotating the loose sleeve.

967,404. OUTLET-BOX. Norman Marshall, Newton, Mass., assignor to Arrow Electric Company, Hartford, Conn. Filed October 31, 1908. An outlet box is provided with two walls which are substantially at right angles to each other, an aperture through one wall, and a screw-threaded nipple extending through the aperture and provided with a head arranged to engage the interior of the other wall and to be held from turning by such engagement, whatever the position of the nipple in the aperture.

967,409. TELEPHONE SIGNAL ATTACHMENT. Wenceslaus F. Mikolasek, Scotland, S. D., assignor of one-fifth to John F. Schmidt, one-fifth to Frank L. Wheeler, and one-fifth to Petie O. Stonebraker, Scotland, S. D. Filed March 9, 1909. A telephone system comprises a base, springs mounted on the base adapted for engagement upon the raising of the receiver of the telephone to close a buzzer circuit to the telephone line, springs disposed on the base for normally opening a talking circuit through a telephone and springs mounted on the base adapted to close the telephone circuit through the receiver.

967,458. SHADE-HOLDER. Edwin T. Stoddard, Whittier, Cal. Filed July 28, 1909. A shade comprises a dished body portion, studs secured thereto near the upper end thereof, an M-shaped compression spring mounted on the outer side of the shade and secured to the studs, loops formed in the extremities of the spring and a band secured at its ends to the loops for holding the shade in position.

967,469. X-RAY APPARATUS. Harry F. Waite, New York, N. Y. Filed July 5, 1906. An X-ray apparatus comprises a supporting frame having pairs of spaced side members, a slide in sliding engagement with each pair of spaced side members, an X-ray tube housing mounted on horizontal pivots in the slides, a tube connected with the supporting frame, and a counter-balance weight in the tube connected to the slides.

967,472. CLOTH-CUTTING MACHINE. John Robert Warren and Thomas Barnard, Toronto, Ontario, Canada, assignors to Eastman Machine Company Limited, Toronto, Canada. Filed June 13, 1908. Serial No. 438,296. A cloth-cutting machine comprises two laterally disposed magnet coils, pole-piece members for the magnet coils formed with an annular chamber for the armature, a bearing for one of the journals of the armature shaft connected to one side of the pole-piece members, a main frame having an annular armature chamber connected to the other side of the pole-piece members, a bearing in the main frame for the other journal of the armature shaft, the main frame having a number of perforations surrounding the last-mentioned bearing, air ducts formed through the armature, a fan revoluble with the armature for creating a suction through the air ducts, a knife and operable means actuated by the armature for causing the motion of the knife cooled by the air passing through the perforations in the main frame.

967,474. BRUSH-HOLDER. Robert B. Williamson, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed October 6, 1909. A brush holder comprises a clamp having two parts which embrace a section of the stud and are secured together at diagonally opposite corners of the stud, a pivoted arm secured to the side of one of these parts, and a brush carried by the arm.

967,475. TELEPHONE SYSTEM. Charles S. Winston, Chicago, Ill.,

assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Describes connections of supervisory signals, etc.

967,508. ELECTRIC-LIGHT BUTTON. Joseph Fortas and Joseph R. Jackson, Memphis, Tenn. Filed December 3, 1909. A turn-button consists of a body portion formed with a chamber terminating at one end in a reduced opening, and a clasp held in the chamber and embodying relatively flat jaws terminating in transversely rounded tongues which protrude through the opening.

967,527. BRUSH-HOLDER. Earle R. Knight, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed February 4, 1905. A brush holder comprises side plates formed of separate sheet-metal punchings, means for holding the side plates at a predetermined distance apart, comprising tubes having their ends expanded in openings in the side plates and spacing sleeves mounted on the tubes, a support for the brush holder, and bolts passing through the tubes for fastening the holder to the support.

967,534. DEVICE FOR ATTACHING SHADE-HOLDERS TO SOCKETS. Anker S. Lyhne, Bridgeport, Conn. Original application filed February 18, 1909. Divided and this application filed June 16, 1909. An attaching device comprises a body with a flange having an internal groove and slots and a spring locking sleeve having lugs which engage the groove in the locking position and spring into the slots in the unlocking position, the inner sides of the lugs comprising grooves adapted to receive the rib on a socket shell, and means for operating the sleeve.

967,564. CABLE-HANGER. Charles E. Robinson, La Crosse, Wis., assignor of one-third to Frank L. Shuman, La Crosse, Wis., and one-third to Joseph A. Becker, Milwaukee, Wis. Filed August 19, 1907. A cable-hanger comprises a clip formed of a single wire bent at its middle portion to form a closed eye with its ends twisted and bent to form a pair of twin hooks in approximately parallel planes with the plane of the eye, and a flexible band passing through the eye of the clip and forming a slip-noose for engaging a cable.

967,575. LIQUOR AGING AND PROCESSING APPARATUS. John Seitz, Chicago, Ill. Filed February 3, 1909. The device described includes an electrode comprising a bung externally tapered and threaded for the entire length of the tapered part, a metallic point of high conductivity projecting from the inner end thereof, a nonconducting bushing for insulating the point from the bung, flanges on the bushing and the conducting point adapted one to engage against the other for limiting the outward adjustment of the conducting point, a conductor leading from the metallic point to a source of electric supply and a gland in the bung surrounding the conductor and bearing against the electrode.

967,578. ART OF ELECTRIC WELDING AND REPAIRING. Heinrich L. J. Siemund, New York, N. Y. Filed June 3, 1909. The method of electric welding or repairing consists in establishing an electric welding arc between the places to be welded or repaired and the welding or repair metal, maintaining a substantially constant load on the generator supplying the welding current, and likewise maintaining the voltage of the welding current, during temporary cessations of the welding arc, in such manner that after any such temporary cessation the circuit will remain in condition to instantaneously re-establish the normal welding arc.

967,579. METHOD OF ELECTRIC WELDING AND REPAIRING. Heinrich L. J. Siemund, New York, N. Y. Filed January 19, 1910. The method of electric welding or repairing consists in establishing an electric welding arc between the metallic object to be welded or repaired, and the end of a rod of the welding or repairing metal, the heat of the arc being sufficient to raise the parts to be welded or repaired to incipient fusion and to cause the end portions of the rod to melt and unite with substantial homogeneity to the fused portions of the piece being welded or repaired.

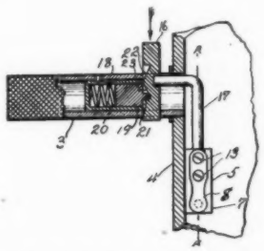
967,590. MANUFACTURE OF STEEL. William R. Walker, New York, N. Y. Filed April 21, 1906. The method described consists in treating iron in an open-hearth furnace or Bessemer converter and removing therein silicon, thence charging the metal into a mixer and removing therefrom from time to time as required charges of the metal and treating them in an electric furnace having a nonoxidizing atmosphere.

967,597. DIFFERENTIAL GALVANOMETER. John L. Zander, Newark, N. J. Filed March 16, 1910. The instrument comprises a pair of horseshoe magnets and a wire-wound coil encircling a pole member of each magnet and moving relatively to the pole member, the pole members tapering toward the pole ends.

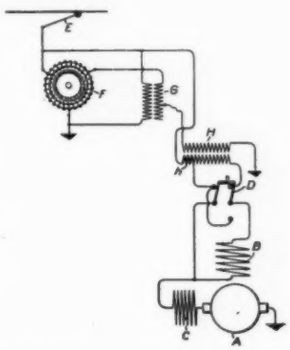
967,631. ELECTRIC TERMINAL. Eduard Gerhardt, Jr., Mauer, near Vienna, Austria-Hungary. Filed October 15, 1908. In combination with a body of insulating material having formed therein two passages both adapted to receive conductors, is an electric terminal having two arms or members engaging opposite walls of one of the passages, and a third member extending from one edge of the connection between the arms into the other of the passages.

967,632. COMBINED JUNCTION-BOX AND CUT-OUT AND SWITCH-SUPPORT. William J. Gibbons, Philadelphia, Pa. Filed June 2, 1909. The junction box has a removable cover, the wall of the box nearest to the cut-out devices being removable.

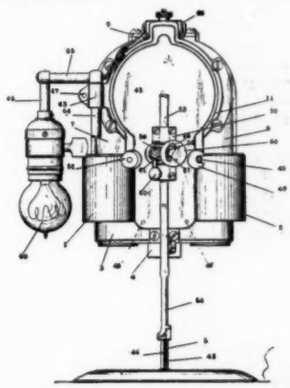
967,633. CIRCUIT-MAINTENANCE SYSTEM. Albert Goldstein, New York, N. Y., assignor to Automatic Fire Protection Company. Filed January 22, 1906. The system comprises a circuit to be maintained, a source of current supply therefor, a pair of magnets in the circuit each having an armature, connections from the armatures to the circuit to be maintained on adjacent sides of their respective magnets, a back contact for each armature arranged for connection with the ground, means actuated by each armature for controlling the ground connection of the opposite armature, and means for retarding the movement of each armature toward its back contact.



967,190.—SWITCH FOR ELECTRIC TOOLS.



967,295.—BRAKING ALTERNATING CURRENT MOTORS.



967,472.—CLOTH-CUTTING MACHINE.

967,635. DEVICE FOR REMOVING METALLIC COVERINGS FROM INSULATED CONDUCTORS. Wallace B. Hewitt, West Pittsburg, Pa., assignor to Safety Armorite Conduit Company, Pittsburg, Pa. Filed April 8, 1908. A hand tool comprises a tubular holder having work-gripping devices therein, means for actuating the devices to grip and release the work, a head rotatably mounted upon one end portion of the holder, a pair of jaws pivoted to the head, a cutting tool mounted on one of the jaws (this jaw having a lever extension), a connection between the jaws, and means for actuating the connection to feed the cutting tool to the work.

967,636. DEVICE FOR REMOVING METALLIC COVERINGS FROM INSULATED CONDUCTORS. Wallace B. Hewitt, West Pittsburg, Pa., assignor to Safety Armorite Conduit Company, Pittsburg, Pa. Filed July 11, 1908. A hand tool comprises a holder having a gripping chuck, means for setting and releasing the chuck, a member rotatably mounted on the holder, a hand lever pivoted to the member, a cutting tool carried by the lever, and means for moving the hand lever and cutter to the work as the tool is operated.

967,649. MEANS FOR VISIBLY INDICATING FAULTY INSULATORS. Charles Linke, Strassburg, Germany. Filed June 30, 1909. A highly inflammable, insulating member applied to the insulator is adapted to be consumed by the arc arising on short-circuiting or earth-connection.

967,658. FIRE-ALARM. Francisco E. Oviedo, Mexico, Mexico. Filed July 2, 1909. A cord released by the melting of a fusible substance establishes an electric circuit to operate a signal.

967,681. ELECTRICAL TRAIN SYSTEM. James R. Sloan, Altoona, Pa., assignor to Gould Storage Battery Company. Filed

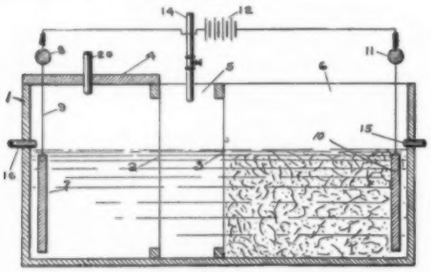
November 16, 1906. Connections for adjacent cars are described.

967,684. ARC-LAMP. Charles H. Sprague, Newton, Mass., assignor to Starbuck Sprague, Boston, Mass. Filed July 16, 1908. In an arc lamp having a pair of downwardly converging electrodes are a flexible strip of fusible material; two downwardly extending rods adjacent to and parallel with each other, the rods being formed with longitudinal grooves in their adjacent sides in which the fusible strip is slidably held; means for guiding the lower end of the strip into contact with one of the electrodes at a point near the arc and means for supporting one of the electrodes by the fusible strip whereby the electrode is prevented from feeding until the end of the strip is sufficiently heated to cause it to yield at its lower end.

967,687. RAIL-JOINT. William P. Thomson and Samuel G. Thomson, Philadelphia, Pa., assignors to Thomson-Thomson Company, Philadelphia, Pa. Filed December 27, 1907. An insulated joint.

967,692. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed January 22, 1907. A party-line telephone system.

967,738. ELECTRIC ARC LAMP. Thomas Joseph Digby, London, England. Filed September 8, 1908. An electric arc lamp for theater stages comprises two notched shutter plates placed in front of the carbons and approximately parallel to the same, with a pair of parallel spindles mounted right and left of the carbons, each spindle carrying at the front end one of the shutter plates and at the rear end a spur wheel, a pinion mounted between the spur wheels and gearing into the same, a tubular shaft carrying at the front end the pinion and at the rear end means for turning the shaft, a regulating shaft extending axially through the hollow shaft and carrying at the rear end a hand wheel, while the front end carries a pinion, and mechanism adapted to be operated by the pinion for regulating the distance between the carbons.



967,762.—PROCESS OF FORMING GLUE FROM LEATHER.

967,747. TRANSMITTER MOUTHPIECE. Oscar F. Falk, Belleville, N. J., assignor to National Dictograph Company. Filed July 13, 1909. A mouthpiece for a telephone transmitter, comprises a channel the sides of which flare evenly and without substantial change of direction outward from a plane closely adjacent to the diaphragm, to the sound-receiving end of the channel, a hollow conical member, diametrically opposite elements in the surface of which form an angle with each other of considerably more than ninety degrees, and means for supporting the member in close proximity to the sound-receiving end of the channel, the apex of the conical member being outwardly disposed with respect to the diaphragm and the periphery thereof being spaced from the tapered wall of the channel to afford a narrow annular passage thereinto.

967,748. TELEPHONE DICTATING MACHINE OR APPARATUS. Oscar F. Falk, Belleville, N. J., assignor to National Dictograph Company. Filed July 13, 1909. A telephone system comprises a manager's instrument having a casing, a prismatic skeleton frame contained therein, keys and signals supported by the frame, a swinging frame pivoted to the suppiemental frame, and a transmitter and receiver fixed to the swinging frame.

967,753. SWITCH FOR ELECTRIC LIGHT SOCKETS. Charles D. Gervin, New York, N. Y. Filed October 28, 1909. A pull-chain socket switch.

967,762. PROCESS OF FORMING GLUE FROM LEATHER. Henry G. Halloran, Brighton, Mass., assignor to Methalco Chemical Company, Providence, R. I. Filed December 27, 1909. An improved process for detanning leather consists in treating the leather in a bath of sodium chloride by electrolysis, thereby decomposing the solution into caustic soda and chlorine, the leather being subjected to the action of the caustic soda thus formed, then washing the leather and treating the same to a bath of chlorine, again washing the leather to be subsequently treated in any manner desired, then mixing the caustic soda drawn from the electrolyzing bath with this chlorine fluid containing the chrome or tanning agent in solution, thereby causing the precipitation of the tanning agent and forming sodium hypochlorite, NaClO, and sodium chloride, NaCl, to be used over again as a detanning agent.

967,766. ELECTRIC ALARM. Harry D. Hanson, East Boston, Mass. Filed April 24, 1909. An electric alarm clock.

967,773. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. Newman H. Holland, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed November 23, 1907. In combination with an intercommunicating telephone system is a trunk line leading from a central office exchange to the intercommunicating system and multipled with two or more stations thereof, a bridge of the trunk line being common to the stations, and circuit-closing devices at each of the stations for substituting the bridge for the telephone set of that station to maintain the circuit continuity of the trunk line.

967,782. MOTOR-CONTROLLING APPARATUS. Samuel H. Keefer, Plainfield, N. J., assignor to Niles-Bement-Pond Company, Jersey City, N. J. Filed April 14, 1910. The system includes a motor; a reversing switch therefor including two solenoids; means for controlling the energization of the solenoids; and a winding having a core placed to magnetically act on the movable members of the solenoids to prevent movement thereof when the motor is running, until the counter electromotive force of the motor has fallen to a predetermined amount.

967,847. REGULATOR. Louis R. Smith, Chardon, O. Filed April 6, 1909. Means for automatically regulating the outflow of liquid from a receptacle after the same has been boiled to a predetermined temperature, include a valve for closing the outlet, an electric controller for opening the valve included in an electric circuit, a thermal circuit closer actuated by the temperature of the liquid whose discharge from the liquid receptacle is to be automatically governed, a signal included in an electric circuit adapted to be closed by the thermal circuit closer, and means for breaking the signaling circuit actuated by opening of the valve.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired August 22, 1910:

503,568. STARTING DEVICE FOR ELECTRIC MOTORS. Alton D. Adams, St. Paul, Minn.

503,570. ELECTRIC RAILWAY TROLLEY-SWITCH. John H. Allison, Elkhart, Ind.

503,574. DYNAMO-ELECTRIC MACHINE OR MOTOR. Charles S. Bradley, Avon, N. Y.

503,581. SELF-EXCITING ALTERNATING-CURRENT ELECTRIC GENERATOR. Philip Diehl, Elizabeth, N. J.

503,589. ELECTRIC-MEASURING APPARATUS FOR ALTERNATING CURRENT. Sydney Evershed, London, Eng.

503,590. TELEGRAPHY. Stephen D. Field, Yonkers, N. Y.

503,595. ELECTRIC METER. Fred L. Gregory, Niagara Falls, N. Y.

503,602. ELECTRIC SEARCH-LIGHT. Rudolph M. Hunter, Philadelphia, Pa.

503,604. ELECTRIC CABLE. Milo G. Kellogg, Chicago, Ill.

503,621. SYSTEM OF ELECTRICAL DISTRIBUTION. Oliver B. Shallenberger, Rochester, Pa.

503,622. SYSTEM OF ELECTRICAL CONVERSION AND DISTRIBUTION. William Stanley, Jr., Great Barrington, Mass.

503,650. INCANDESCENT ELECTRIC LAMP. Edward E. Cary, Boston, and William E. Nickerson, Cambridge, Mass.

503,669, 503,670 and 503,671. INCANDESCENT ELECTRIC LAMP. William E. Nickerson, Cambridge, Mass.

503,688. ELECTRIC-LIGHTING SYSTEM. Lucien Vialet-Chabrand, Ciotat, France.

503,690. APPARATUS FOR CONTROLLING ELECTRIC MOTORS. Schuyler S. Wheeler, New York, N. Y.

503,693. SWITCH FOR ELECTRIC LIGHTS. Ernest Blasser, Boston, Mass.

503,709. ELECTRIC SIGNAL DEVICE. Carl Schwennicke, Berlin, Germany.

503,710. CONTACT FOR CONDUIT ELECTRIC RAILWAYS. Adolf Worner, Budapest, Austria-Hungary.

503,718. BLOCK SIGNAL INDICATING MECHANISM. Johann H. Frischen, Berlin, Germany.

503,727. ELECTRO-MAGNETIC SAFETY-COUPLING. Ernst Richter and Carl Hoffman, Berlin, Germany.

503,749. SECTION INSULATOR. Louis McCarthy, Boston, Mass.

503,750. REGULATING APPARATUS FOR ELECTRIC MOTORS. Charles H. Richardson, Philadelphia, Pa.

503,770. INCANDESCENT ELECTRIC LAMP. William E. Nickerson, Cambridge, Mass.

503,775. ELECTRICAL CONTACT DEVICE. James K. Pritchard, Providence, R. I.

503,778. INSULATOR FOR ELECTRIC WIRES. William D. Trimble, Hanesville, Md.

503,799. ELECTRIC-ARC LAMP. Walter W. Millard, Fenton, Mich.

503,805. ELECTRIC METER. Anthony Reckenzaun, London, Eng.

503,811. ELECTRIC BELT. Adolf Stephenson and Jonas Backstrom, Stromburg, Neb.

503,867. ELECTRICAL CUT-OFF. Lewis B. Matson, Elmira, N. Y.

503,873. ELECTRICAL CONDUIT FOR BUILDINGS. James J. Powers and Robert Van Buren, Brooklyn, N. Y.

503,912. COMBINED GAS AND ELECTRIC-LIGHT FIXTURE. James A. O'Neill, Boston, Mass.